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Social Norms and their Real-Time Influence on Snacking

By

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Statement of Sources

I declare that this report is my own original work and that contributions of others have been duly acknowledged.

Signature:..... ***Date:.....***

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Abstract

Social cues, such as being in the presence of others eating, have a powerful and pervasive influence on snacking behaviour. Previous research suggests that observing others eating leads to the creation of implicit and situation-specific social eating norms which guide appropriate eating behaviour. However, to date, social norms have not been examined in real world settings and in near real-time. Therefore, Ecological Momentary Assessment (EMA) measures were used to collect data from 61 individuals over a 14 day monitoring period. Participants recorded their food intake and responded to questions about social norms when ever they consumed food and at random time points throughout the day. As anticipated, results indicated that being in the presence of others eating significantly increased the likelihood of snacking, and that social norms partially mediated this effect. Importantly, social norms were found to vary from moment to moment and differentially predict snacking depending on the social context. We therefore argue for the importance of examining social norms in real time in order to ascertain their true influence on snacking behaviour.

Eating serves the purpose of restoring the body's nutrients and energy, promoting growth and survival. However, overeating (i.e., consuming energy that is disproportionally large for a given energy expenditure), or eating when not hungry, are key contributors to weight gain (Prentice, 2001) which in turn is associated with increased risk of ill health. Adverse health outcomes associated with excessive weight gain include high blood pressure, heart disease, several types of cancer, diabetes, infertility and depression (Tanamas et al., 2013). Overeating is of particular importance in industrialised countries where individuals have continuous access to a variety of foods and are increasingly over consuming. Such environments with easy access have been termed "obesogenic" (Pinel, 2000). Specifically, in Australia, it is estimated that almost 63% of the population are overweight (BMI > 25) (Australian Bureau of Statistics, [ABS], 2015), with particular high rates of overweight and obesity in Tasmania, the context of this study (Hendrie, Baird, Golley, & Noakes, 2016). The resulting health problems place substantial illness burden on those affected and are estimated to cost the Australian economy $56.6 billion annually (Colagiuri et al., 2010). As eating, particularly snacking, is a major behavioural risk factor for becoming overweight, further research on the situational determinants that prompt overeating is essential. Importantly, research findings have the potential to guide health interventions aimed at changing dietary behaviour and improving health.

Discretionary Food Choices

The consumption of discretionary foods choices (i.e., "snacks") has significantly increased in recent years (Piernas & Popkin, 2010). Although there are a variety of definitions of snacking, for the purpose of this research a snack is defined as any food that is consumed outside of main meals (Twine, 2015; Wansink,

Payne & Shimizu, 2010). Snack foods account for approximately 35% of an individual's total daily energy intake (ABS, 2014). Despite this, individuals are usually unaware of the cues that trigger snacking (Verhoeven, Adriaanse, de Vet, Fennis & de Riddler, 2014). Snack foods tend be energy-dense and are generally high in sugar, salt and/or saturated fat (National Health and Medical Research Council, 2013). As snacking appears to be associated with high caloric intake, and in turn excess weight gain, investigating the factors that influence snacking is paramount. Accordingly, while general theories of eating will be discussed, the focus of this study will be on snacking.

Theories of Eating and Hunger

How people determine what, when and how is appropriate to eat is key to understandings the factors that drive snacking. Early theories of eating emphasized the instinctual nature of eating, whereby hunger was believed to be predominantly driven by a physiological lack of food and a need to restore energy imbalance (Woods, Schwartz, Baskin & Seeley, 2000). Although most theories acknowledge that food consumption and weight are regulated by homeostasis, many have questioned the predominance of the homeostatic influence (Stroebe, Papies & Aarts, 2008). The increasingly high prevalence rates of overweight and obesity in industrialised countries, suggests that food consumption is commonly occurring for reasons other than energy restoration.

More recent theories of eating have evolved from a homeostatic perspective, suggesting that hunger and food consumption are often driven by the anticipated pleasure one will experience from eating (Lowe & Butryn, 2007). Referred to as "hedonic hunger" individuals may experience persisting thoughts, feelings and cravings for food in the absence of physiological energy depletion. These feelings

may be prompted by exposure to food-related eating cues. It has been suggested that individuals often misinterpret the psychological signals they receive from food related eating cues as physiological signs of hunger, often promoting overeating (Lutter & Nestler, 2009). The influence of eating cues is specified in Stimulus Control Theory, which suggests that eating cues, rather than internal states (hunger and satiety), influence dietary behaviour (Lowe et al., 2009). Eating cues may be internal or external, but are not motivated by homeostatic hunger. Internal cues may be different mood states (e.g., stress, negative affect or arousal), or a desire for pleasure. External cues include both environmental cues (e.g., seeing or smelling food or seeing food advertising) and social cues, such as being in the presence of others eating. De Castro (1993) reports that more than 86 per cent of human food consumption can be attributed to cues within an individual's immediate and social environment, which suggests that we do not usually snack because we are hungry, but because they see or encounter something in our environment that prompts them to eat (Weingarten, 1985). Importantly, research suggests that snack foods appear to be more influenced by eating cues than main meals (Cleobury & Tapper, 2014). Further, snack intake driven by internal and external cues, often results in an over consumption of food intake that exceeds homeostatic needs and therefore presents a risk factor for weight gain (Hetherington, 2007).

The Effects of Social Cues on Snacking

The role of social cues has recently been highlighted as a major influence on consumption decisions. Schüz, Bower & Ferguson (2015) examined the influence of social cues (having company, engaging in activities and observing others eating), internal states (negative affect and arousal) and environmental cues (availability of food) on the likelihood of eating a meal or snack. Among these predictors, social

cues (specifically observing others eat) provided the strongest cue to snacking, increasing the likelihood more than fivefold. Further, Elliston, Ferguson, Schüz and Schüz (2016) replicated these findings among an overweight and obese sample of individuals, revealing that social cues (observing others eating) increased the likelihood of snacking more than threefold. These findings are consistent with previous research suggesting that social cues are one of the greatest influences on eating behaviour (Burger et al 2010; Prisnsen, de Riddler & de Vet, 2013). It has become increasingly acknowledged that eating is influenced by social context, and that eating patterns change during social encounters. Specifically, it is believed that the consumption choices of others have a powerful effect on our own eating decisions (Higgs, 2016; Higgs & Thomas, 2016). As eating often takes place in a social context, it is critical to understand how and why, our eating companions influence how we snack. In a systematic review, Herman, Roth and Polivy (2003) summarised the existing literature and proposed that eating behaviour is affected by the presence of others in three distinct ways: via social facilitation, impression management or via modelling of food intake.

Social facilitation.

Social facilitation is observed when individuals eat more in the presence of others than when they are alone. Early food diary studies indicate that people consume up to 44% more food when in the company of other people compared to when they eat alone (de Castro, 1994). Further, diary studies have revealed that as the number of diners increases, so too does the amount of food eaten by each person. However, this finding tends to only occur when individuals are eating in the presence of friends and family (de Castro, 1990; Hetherington, Anderson, Norton & Newson, 2006). Social facilitation effects have also been observed in laboratory

studies. For example, Berry, Beatty and Klesges (1985) found that participants ate significantly more ice cream when in small groups than when alone. Likewise, Edelman, Engell, Bronstein and Hirsch (1986) found that males ate significantly more pizza when eating in groups of 4-5 people than when alone. Overall, research findings consistently reveal that people tend to consume more when eating with others than when eating alone, and that this effect is stronger as the number of diners increases.

Impression management.

A second social influence affecting eating is impression management, which suggests that being in the presence of others does not always facilitate eating, but may instead inhibit food intake. Impression management is thought to inhibit food intake as individuals reduce their consumption to create an impressionable image of themselves to the people they are dining with, whom they presume are socially evaluating them (Vartanian, 2015). For example, women may eat smaller amounts of food when they are in the presence of a potential romantic partner as they perceive eating minimally will create a favourable self-impression. Further, when dining with males, women are more likely to select foods that are lower in calories than when dining with other women (Young, Mizzau, Mai, Sirisegaram & Wilson, 2009). Indeed, eating minimally is associated with positive stereotypes such as self-control, discipline and femininity in women. In impression management studies, researchers either inform participants that their food consumption is being monitored, or include a non-eating confederate who observers the participant's eating. Either way, research findings generally indicate that the observation of others has a suppressive effect, inhibiting eating (Conger et al., 1980; Polivy, Herman, Hackett & Kuleshnyk, 1986).

Modelling of food intake.

Modelling of food intake occurs when individuals directly adapt and modify their eating to match that of others around them (Cruwys, Beverland & Herman, 2015). For example, it is often observed that individuals order desert at restaurants when their eating companions do, despite reportedly feeling full. Early modelling studies typically involved a single participant eating with an experimental confederate who purposefully ate either a small or large amount of food. In these studies, findings revealed that participants mimicked the consumption decisions of their eating companion, eating more when others ate more, and eating less when others ate less (Conger et al., 1980; Nisbett & Storms, 1974; Rosenthal & McSweeny, 1979). Interestingly, modelling effects have been found to persist even when participants are very hungry. For example, Goldman, Herman and Polivy (1991) had their participants fast for 24 hours prior to the experiment. Findings indicated that both food deprived and non-deprived participants modelled the eating behaviour of the confederate. Specifically, deprived participants ate minimally when the confederate ate minimally despite their intense hunger. These findings emphasize the power of social influences on eating, as social cues persisted to govern food intake despite the presence of intense physiological cues. Further, a recent meta-analysis of 69 experimental studies revealed that modelling is a profound and robust phenomenon, that influences both the quantity and type of food that people eat (Cruwys et al., 2015). Indeed, 64 studies revealed statistically significant modelling effects (large effect size on average) over a range of methodologies, food types and social contexts. Results indicated that modelling is not moderated by individual or demographic variables and occurs regardless of BMI, sex, dieting status, personality type, current health goals and hunger levels.

Normative Theory of Social Influence

It is clear that the presence of others has a powerful impact on our consumption decisions, both facilitating and inhibiting food intake. Although a range of evidence has been put forth, how the presence of others specifically affects our food intake remains mixed and unclear. While a number of factors are known to play a role, social norms are one mechanism proposed to underpin the effects of social influence on eating. Social norms in general are implicit codes of conduct that guide appropriate behaviour (Higgs, 2016). Specifically, social eating norms are the standards of appropriate eating for a given social group. They are set by the behaviour of others, common cultural expectations and environmental cues that convey socially appropriate eating behaviour (Higgs & Thomas, 2016). Descriptive social norms reflect people's perceptions of common behaviour (what others do), whereas injunctive social norms refer to perceptions of behaviours that are perceived as being approved of (what others think you should do).

In light of these divergent social influence effects, suggesting that the presence of others both facilitates and inhibits food intake, Herman et al. (2003) proposed a normative model within a general theory of social influence on eating that could explain these contradictory findings. This theory proposes that eating is driven by the presence of palatable food, and that social influences act to guide food consumption. Specifically, they suggested that most individuals are concerned with avoiding eating excessively. Indeed, excessive food consumption is often associated with negative stereotypes such as lack of self-control and unattractiveness (Vartanian, 2015). According to the normative model, people engage in social comparison to determine how much they can eat without eating excessively. Therefore, one's eating companion serves to establish guidelines indicating how much is appropriate to eat. If an eating companion consumes a large amount of food,

they permit an individual to also consume larger amounts without appearing to eat excessively (often more than one would normally eat when they are alone). Simply put, the people one is surrounded by provide information about what and how much food is appropriate to eat in a given setting.

Herman et al. (2003) argued that this normative model can account for both the facilitation and inhibition of food consumption observed when people eat with others. Therefore, they suggested that social influence effects such as social facilitation, impression management and modelling are underpinned by the operation of social norms. Specifically, Herman et al. (2003) suggested that social facilitation effects were accounted for by an avoid-excess norm, whereby individuals are motivated to consume as much as possible when in the presence of others without appearing to eat excessively. In doing so, individuals consume more food in a social setting as they are more likely to follow the norms of over consumption (without eating excessively) than they are to eat moderately. However, as this norm cannot account for impression management effects, in which individuals eat small amounts to make a good impression on others, they suggested that a minimal-eating norm may also operate in some situations. In this case, experiencing potential judgment from an eating companion renders the individual to be more concerned with eating minimally than avoiding eating excessively.

In regards to modelling of food intake, Herman et al. (2003) suggested that people model the food intake of others as social models provide a norm of appropriate intake which is presumed to be an appropriate lead to follow. Specifically, in situations without clear ideas about the correct or appropriate amount of food to consume, we model our eating behaviour on that of others. Therefore, individuals' perceptions of normative eating behaviour changes in different social

contexts and in response to different eating companions. Whether eating is facilitated, inhibited or modelled depends on how much others eat and the extent one wishes to impress them.

Momentary Eating Norms

A number of laboratory studies support the normative model, acknowledging that food consumption is largely guided by the eating decisions of others (Burger et al., 2010; Hermans et al., 2012; Higgs, 2016; Prinsen et al., 2013). Although is it agreed upon that individuals generally follow social norms to eat appropriately and avoid excessive consumption, recent literature has indicated that norm perceptions change from moment to moment, depending on the social situation. For example, Shimizu, Johnson and Wansink (2014) investigated how participants' food consumption changed depending on the physical appearance of their eating companion. Participants dined with a normal weight confederate or an overweight confederate wearing a prosthetic 'fatsuit'. After observing the confederate eat either pasta (high-energy food) or salad (low-energy food), participants were secretly observed serving themselves. Results indicated that participants ate significantly larger amounts of pasta when the confederate was wearing the fatsuit than when she was not. This suggests that the presence of an overweight confederate affected the norm perception of participants as they modified their eating behaviour according to the confederate's body type.

Studying Momentary Norms in Real-Time

Findings from Shimizu et al. (2014) highlight that the effects of social norms in predicting eating behaviour vary between situations. Accordingly, this study aims to examine social norms in every day settings and in real-time to to account for their momentary nature. To date, research on the influence of social norms has utilized

laboratory based methodologies. However, examining the operation of social norms in laboratory conditions does not account for the potential momentary and situation-specific nature of norms, and may therefore be limited in ecological validity. For this reasons, this study employs the use of Ecological Momentary Assessment (EMA) procedures (Shiffman, Stone & Hufford, 2008) which allow participants to record their food consumption on an electronic mobile device as they go about their daily life. Participants log their food intake on their device in near real-and report contextual and environmental details about the situation they are in when eating. In doing so, they report moment-to-moment environmental and social exposures, allowing social norms to be studied in real-world settings in near real-time.

Rationale and Aims

Social cues have a powerful and pervasive influence on eating behaviour, but previous research has mainly examined static effects of social cues on eating. Accordingly, this study will further examine the impact of social cues (specifically observing other eating) on snacking behaviour. In line with previous research suggesting that social norms account for social influence effects (Herman et al., 2003), and that social norms are situationally variable (Shimizu et al., 2014), this study will examine for the first time, whether momentary social norms mediate the effects of social cues (observing others eating) on snacking. This research project will therefore aim to examine the impact of social norms on snacking in both healthy weight and overweight individuals at the time they decide to eat. In doing so, it will be the first study to examine how perceived momentary norms for appropriate eating behaviour impact consumption decisions using real-time data assessment. Previous studies have examined the role of social norms, but to date, no study has examined

the influence of social norms on real-time snacking behaviour. To do this, this study examines two broad research questions:

Research question 1: To what extent is eating a snack influenced by observing others eating? In line with previous research that suggests individuals modify their consumption to match that of their eating companions, it is hypothesized that participants will be more likely to snack when they observe others eating.

Research question 2: Do momentary norms mediate the effect of observing others eat on snacking? It is hypothesized that momentary norms (approval and encouragement) will mediate the effect of observing others eat on snacking.

Method

Overview

The aim of this study was to examine the impact of momentary social norms on eating behaviour, with the use of Ecological Momentary Assessment (EMA) methods (Shiffman et al., 2008). Participants were required to record their eating in real-time using a customized hand-held mobile phone and respond to questions about eating cues as well as momentary social norms whenever they consumed food, and at random time points throughout the day (see Figure 1 for a conceptual diagram). This study followed established protocols when instructing participants to use to the EMA devices, in accordance with previous EMA eating studies (Schüz et al., 2015; Schüz, Schüz & Ferguson, 2015). This study was approved by the Tasmanian Social Science Human Research Ethics Committee (H0015647).

Participants

A community sample of 61 adults were recruited for this study. Participants were recruited via a newspaper article in *The Examiner* (May 12, 2016), a University

of Tasmania media release (May 11, 2016), and an *ABC* radio interview (May 18, 2016). To be eligible to participate, individuals were required to be ≥18 years of age, have a BMI between 18 and 40 (i.e. within the normal-to-overweight BMI range), not be on a diet, and have no previous diagnosis of an eating disorder. These exclusion criteria were based off previous EMA eating studies in a non-clinical population (Schüz et al., 2015). Further, no attempts were made to have approximately equal proportions of demographic variables (e.g. race). Participants who completed the study were eligible to receive $50, or receive institutional credit for research participation.

Procedure

Procedures for this study followed those outlined in previous published research (Elliston et al., 2016; Schüz et al., 2015). Initially, interested participants contacted the researchers via a web form. The researcher then conducted a brief telephone screening of exclusion criteria prior to booking them in for their first of three study visits the Sandy Bay campus of the University of Tasmania. Eligible participants provided written consent before any research procedures began. Data was collected between April and August, 2016.

At the first study visit (~30 minutes in duration), participants met with the researcher where their contact details were recorded and a baseline questionnaire was completed (see Appendix B). The baseline questionnaire assessed participants' everyday eating and drinking patterns and some personality traits through the use of the Behavioural Activation Scale/ Inhibition Scale (Carver & White, 1994), the Power of Food Scale (Lowe et al., 2009), and the Yale Food Addictive Scale (Gearhardt, Corbin & Bronwell, 2009). These assessments form part of a related research project but fall beyond the scope of this thesis. Following completion of the

baseline questionnaires, participants were issued with a smartphone that had been programmed with study-specific software (HBART, 2012). Each participant received individualized training by the researcher during their private visit to learn to use the EMA device correctly. Each participant was also given time to practice answering assessment reports on the device prior to the commencement of their monitoring period and given an EMA training manual to take home for further reading.

Participants were instructed to record each time they consumed a meal, snack or drink (excluding water) on the EMA device for the 14 days of their participation. After each report, the device created a time stamp which documented when the report was completed. When logging an eating or drinking event, participants were asked a random subsection of follow-up assessment questions examining the presence of internal and external cues at the time they decided to eat (see assessment below for details). While every food and drink log was recorded with a time stamp, only a random subsample (~60% of all eating and drinking events reported) were followed with all assessment questions in order to minimise participant burden. In addition, the EMA devices were programmed to randomly remind participants (~3-5 times per day) to complete "non-eating assessments", which asked the same set of assessment questions as in the food reports but at non eating time points. This allows the use of these "non-eating assessments" to act as a comparison event to the eating and drinking logs. Participants were instructed to turn the device to "suspend mode" whenever they were in circumstances where they would not be able to answer random prompts (such as when driving). Further, between the hours of 7pm and midnight each night, participants were asked to complete an "evening report" which collected a global assessment of their mood, cravings, daily exercise and food intake

over the day. The evening report assessments will form part of a related research project but again, fall beyond the scope of this thesis. Finally, participants were instructed turn the device to sleep mode for the night which set an alarm to wake up.

At the second study visit (~2-4 days into the monitoring period), participants returned to the lab for a brief check-up visit (~10 minutes). Participants' EMA data was uploaded and checked to ensure they had been using the device correctly and adhering to the study protocol. If compliance with random prompt monitoring was <100%, participants were retrained in using the device and given time to discuss any any confusions or concerns they had about the study protocol or assessment questions.

At the third study visit (~14 days into the study), EMA monitoring ceased. Participants returned to the lab for a final brief visit (~10 minutes), where they returned their device, were debriefed and thanked. Participants' data was uploaded and confidentially stored on a secure server on a password-protected computer. During this visit participant's received $50 in cash or 3-hours research participation (for first year psychology students) as reimbursement for their time and contribution to the study.

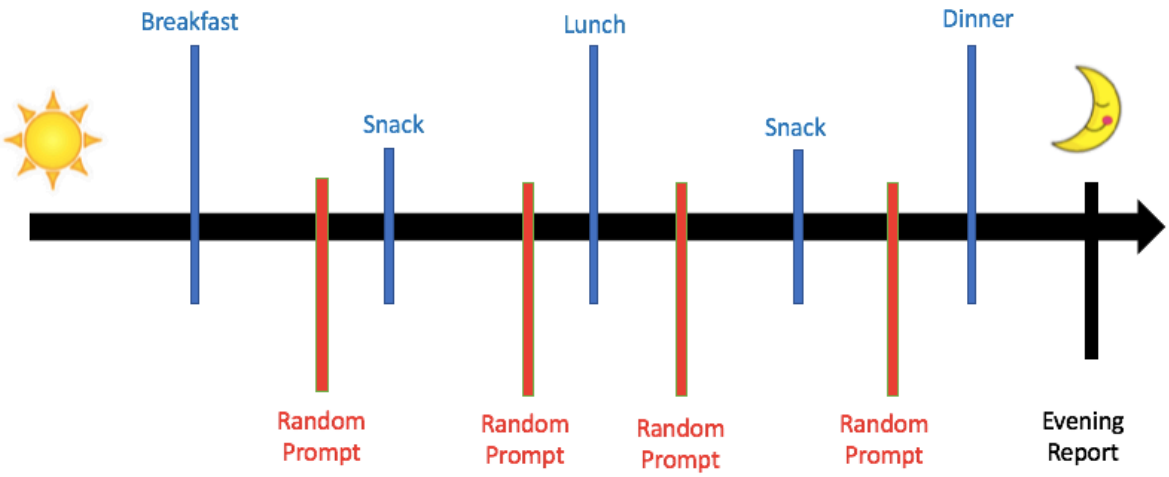

Figure 1. Conceptual diagram of an average day using EMA.

Assessment

All assessment reports were administered and recorded using the device's touch-screen, and were based on previous EMA research examining dietary behaviours in a non-clinical population (Schüz et al., 2015). Responses consisted of three types: 1) quantitative responses, 2) qualitative responses where a single option was selected, or 3) qualitative responses where multiple responses were required to be selected. During eating and non eating assessments (random prompts), participants were asked questions regarding their immediate location, food availability, types of food outlets in sight, who they were with and what they were doing, and whether they were experiencing any food cravings. These assessments form part of a related research project and were not analysed in this study. Participants were given the option to go back and edit each response before submitting the report. However, after submission, responses were safely stored on the device and participants could not go back and alter or view their responses.

Assessment of social cues. The presence of other people eating was assessed by asking "When you decided to eat, were there people eating?" Responses were qualitative and required answering a single option from: "no," "yes in my view" or "yes in my group." For analysis, responses were dichotomised to yes/no.

Momentary norms were examined by asking: "Do others approve of you eating right now?" and "Have others had encouraged you to eat right now?" These questions have been developed specifically for this study and were modelled on the assessment of injunctive social norms according to Ajzen (2006) and a social facilitation approach following Cruwys et al. (2015). Responses were quantitative and assessed on a 0-100-point visual analogue scale, where participants moved a pointer to indicate their response score.

Food reports were assessed in two steps. Firstly, participants reported whether they were eating a meal or snack, and secondly identified what kind of food they were eating based on the Dietary Targets Monitor (Lean, Anderson, Morrison & Currall, 2003). Snack reports were dichotomized as "low energy snacks" or "high energy snacks" in order to ascertain an estimate of their degree of caloric intake. Snacks reported as "fruit and vegetables" and "dairy" were classified as "low-energy snacks" and snacks reported as "starchy foods," "meat," "cheese," "sweet and chocolates," "savory" and "cakes, scones, pastry and biscuits" were classified as "high-energy snacks."

Data Preparation and Analysis

In line with previous EMA compliance studies (Schüz, Walters, Frandsen, Bower & Ferguson, 2014), data analysis proceeded by excluding 130 days of poor EMA compliance (<50% of random prompts answered) from the analysis. In line with research questions 1, a two-level multilevel logistic regression model was used to analyse the presence and intensity of social cues in predicting snacking. Importantly, this analyse was used due to the hierarchical structure of EMA data, in which multiple daily assessments of food reports and randomly timed reports are nested within participants.

In line with research question 2, a mediation analysis was used which followed a 1-1-1 mediation model (Krull & MacKinnon, 2001). In these models, the predictor, the mediator, and the outcome are assessed on level 1, i.e., assessments nested within participants. The mediation model tested the effects of observing others eating on snacking (total, high-energy or low-energy) versus random prompts as mediated by approval and encouragement (see figure 4). The mediation model was specified on level 1 with random intercepts of approval and encouragement

predicting snacking varying on level 2 (participants). MPlus was used to obtain estimates of odds ratios and indirect effects in the mediated multilevel logistic regression (TYPE = TWOLEVEL RANDOM; Muthen & Muthen, 1998-2012). Descriptive analyses were conducted using SPSS.

Results

On average, each participant completed 15 days of monitoring (*M*=14.87, *SD*=2.10). Overall, there were 776 participant days of observation available, after days with poor compliance (<50% of random prompts answered) were excluded from the analysis. Over the duration of the study, participants answered 2058 random prompts of the total 2374 issued, averaging 2.75 prompts per day. This resulted in an overall compliance rate of 87%. A total of 1643 meals and 1127 snacks were reported in real time. On average this accounted to 2.26 (*SD*= 0.70) meals and 1.51 (*SD*= 1.09) snacks per day. Of the snacks, participants reported an average of 0.65 (*SD*= 0.48) low-energy snacks per day, and 1.3 (*SD*= 0.75) high-energy snacks per day.

Sample Characteristics

Participants' (42 females, 69%) age ranged from 18 to 64 (*M* =32.23 years, *SD* =12.90 years) and BMI ranged from 18.34 to 38.58 (*M* =24.97, *SD* =4.07). Therefore, participants BMI was slightly below the Australian average BMI of 26.5 (ABS, 2008). 59 (97%) participants were of of Caucasian ethnicity, and two (3%) were of Asian ethnicity. 50 participants (82%) had completed some level of university, 4 participants (7%) had graduated TAFE, and 12 participants (12%) had graduated year 12.

Research Question 1: Direct Effects of Social Influence on Snacking

Table 1 shows that the likelihood of an assessment report being a snack report (total, high-energy snack report or low-energy snack report) rather than random prompt increased if participants were in the presence of others eating.

Table 1

Summary of parameter estimates, standard errors and odds ratios of predicting snacking in the presence of others eating

	Parameter estimate (*SE*)	Odds ratio (95% CI)
Snacks (total)	1.23 (0.14)***	3.63 (2.74, 4.79)
High-Energy Snacks	1.68 (0.17)***	5.36 (3.84, 7.47)
Low-Energy Snacks	0.59 (0.25)*	1.80 (1.11, 2.92)

Note: * $p < .05$, *** $p = .001$.

Momentary Findings

The Intraclass Correlation Coefficients (ICC) were examined to assess whether social norms varied across situations. The ICC indicates the ratio of between and within variance in social norm ratings. The ICC for approval was 0.20, indicating that there was significant variation in approval scores both between participants (σ^2=157.74, p<.001) and within participants (σ^2=623.64, p<.001). Therefore, 20% of the total variance in approval scores was accounted for by differences between participants, whilst 80% was attributable to individual differences. Similarly, the ICC for encouragement was 0.24, again indicating that there was significant variation in encouragement scores both between participants (σ^2=357.61, p<.001) and within participants (σ^2=1120.62, p<.001). Therefore, 24% of the variation in encouragement scores was accounted for by differences between participants, whilst 76% was accounted for by the variation within participants.

Figures 2 and 3 illustrate the between and within participant variance in approval and encouragement mean scores. 95% Confidence Intervals indicate the degree of variation in these scores.

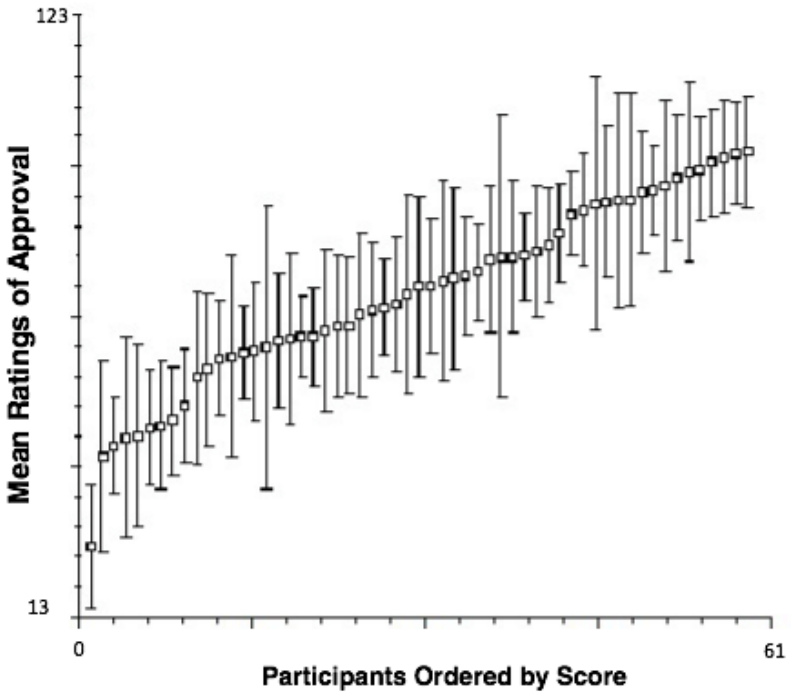

Figure 2. Individual participants mean approval score (and 95% Confidence Intervals), ordered from lowest to highest. *Note.* The y-axis includes out-of-range numbers based on the estimates of the 95% CIs.

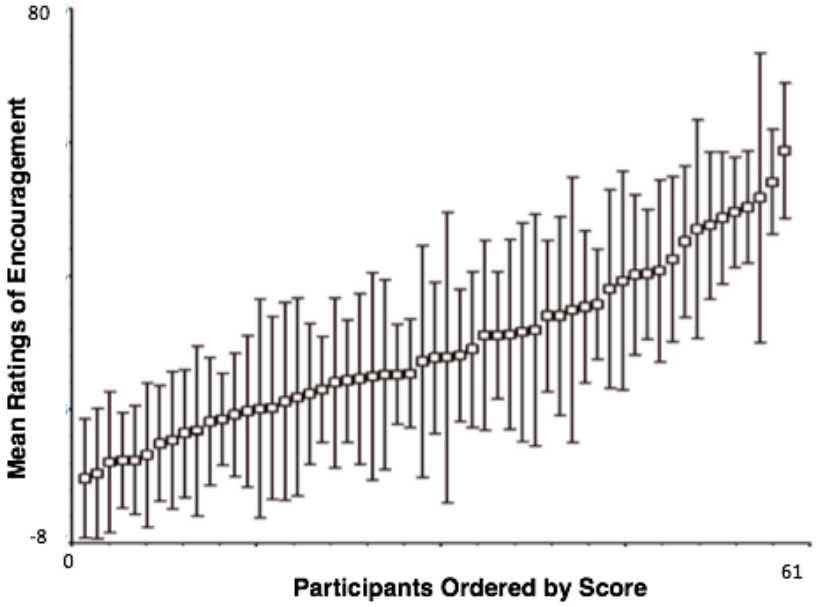

Figure 3. Individual participants mean encouragement score (and 95% Confidence Intervals), ordered from lowest to highest. *Note.* The y-axis includes out-of-range numbers based on the estimates of the 95% CIs.

Research Question 2: Mediation Models

Model 1: Predicting snacking from the presence of others eating.

Whether momentary norms mediated the effects of social cues on snacking, was examined in three mediation models (snacking in total, high-energy snacking or low-energy snacking). As shown in figure 2, for snacking in general, a report was 3.08 times more likely to be a snack report than a random prompt, when participants were in the presence of others eating (B= 1.12, SE= 0.14, p<.001). Observing others eating was a significant predictor of approval, (B= 12.07, SE= 2.57, p<.001) with approval scores increasing by 12.07 out of 100 units when others were eating. Observing others eating was also a significant predictor of encouragement (B= 27.63, SE= 2.51, p<.001) with encouragement scores increasing by 27.63 out of 100 units when others were eating. Approval was a significant predictor of snacking, (B=

0.01, *SE*= 0.003, *p*<.001), with the likelihood of a report being a snack report than a random prompt increasing by 0.12% with one unit increase in approval. Encouragement was also a significant predictor of snacking, (*B*= 0.01, *SE*= 0.003, *p*= 0.02), with the likelihood of a report being a snack report than a random prompt increasing by 0.6% with one unit increase in encouragement. Therefore, of the total effect (*B*= 1.29, *SE*= 0.14, *p*<.001), 14.4% of variance is accounted for by the increase in approval (*B*= 0.144, *SE*= 0.06, *p*= 0.015), and 16.4% by the increase in encouragement (*B*= 0.164, *SE*= 0.08, *p*= 0.033).

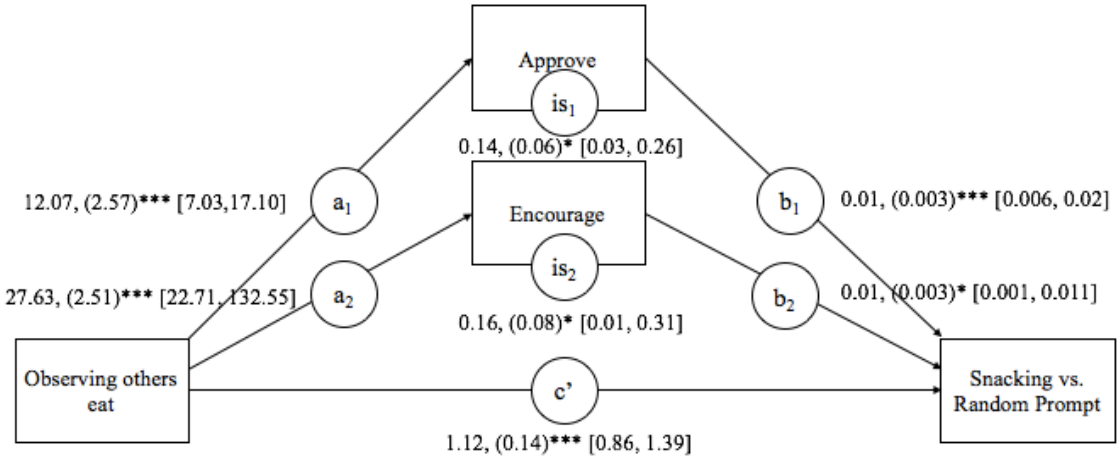

Figure 4. Unstandardized path coefficients for the mediation model predicting snacking from observing others eat, as mediated by approval and encouragement (momentary norms). Standard errors in parentheses and 95% CIs in brackets.
Note * $p < .05$, *** $p = .001$.

Model 2: Predicting high-energy snacking from the presence of others eating.

For high-energy snacking, a report was 4.32 times more likely to be a high-energy snack report than a random prompt, when participants were in the presence of others eating (*B*= 1.47, *SE*= 0.18, *p*<.001). Observing others eating was a significant predictor of approval, (*B*= 12.44, *SE*= 2.52, *p*<.001) as approval scores increased by

12.44 out of 100 units when others were eating. Observing others eating was also a significant predictor of encouragement (B= 27.81, SE= 2.79, p<.001) as encouragement scores increased by 27.81 out of 100 units when others were eating. Encouragement was a significant predictor of high-energy snacking, (B= 0.01, SE= 0.003, p= 0.013), as the likelihood of a report being a high-energy snack report than a random prompt increased by 0.8% with one unit increase in encouragement. Approval, however, was not a significant predictor of high-energy snacking, (B= 0.01, SE= 0.003, p=0.064), as the likelihood of a report being a high-energy snack report than a random prompt increased by 0.6% with one unit increase in approval. Of the total effect (B= 0.29, SE= 0.09, p= 0.001), 7.9% of variance is accounted for by the increase in approval (B= 0.079, SE= 0.05, p= 0.113), and 21.4% by the increase in encouragement (B= 0.214, SE= 0.09, p= 0.021).

Model 3: Predicting low-energy snacking from the presence of others eating.

For low-energy snacking, a report was 1.72 times more likely to be a low-energy snack report than a random prompt, if others were eating (B= 0.54, SE= 0.24, p=0.024). Observing others eating was a significant predictor of approval, (B= 9.13, SE= 2.69, p=0.001) as approval scores increased by 9.13 out of 100 units when others were eating. Observing others eating was also a significant predictor of encouragement (B= 24.34, SE= 2.93, p<.001) as encouragement scores increased by 24.34 out of 100 units when others were eating. Approval was a significant predictor of low-energy snacking, (B= 0.024, SE= 0.01, p<.001), as the likelihood of a report being a low-energy snack report than a random prompt increased by 0.24% with one unit increase in approval. However, encouragement was not a significant predictor of low-energy snacking, (B= 0.002, SE= 0.003, p= 0.603), as the likelihood of a report

being a low-energy snack report than a random prompt increased by 0.02% with one unit increase in encouragement. Of the total effect (*B*= 0.27, *SE*= 0.13, *p*= 0.035), 22.1% of variance is accounted for by the increase in approval (*B*= 0.22, *SE*= 0.11, *p*= 0.043), and 4.3% by the increase in encouragement (*B*= 0.04, *SE*= 0.08, *p*= 0.606).

Discussion

The primary aims of this study were to examine the effects of social cues (observing others eating) on snacking (Research Question 1), and to examine whether, and to which degree, momentary norms mediate the effects (Research Question 2). Food reports and assessments of norms were gathered using EMA methodology over a 14-day monitoring period. Overall, being in the presence of others eating significantly increased the likelihood of snacking, and momentary norms partially mediated this effect.

In accordance with our first research question, social cues (observing others eat) significantly increased the likelihood of snacking. Specifically, being in the presence of others eating was significantly associated with an increased likelihood of eating a high-energy snack, a low-energy snack or a snack in total. These findings are consistent with previous research suggesting that the presence of others eating cues snacking (Elliston, et al., 2016; Schüz, et al., 2015). More generally, our findings further support the idea of context-dependent snacking, whereby an individual's motivation to eat is predominantly guided by environmental factors, particularly social cues, rather than physiological hunger cues (Cruwys et al., 2015).

The findings of this study support a social facilitation effect on snacking, as participants were more likely (not less likely) to snack when in the presence of others eating. Therefore, being in a social setting facilitated the consumption of

snack foods. The idea of impression management, whereby the presence of others suppresses food intake, was not supported. These results suggest that at least for discretionary food choices, social cues are unidirectional, in that they facilitate rather than inhibit food intake. However, an important consideration is that this study measured the likelihood of snacking, rather than the quantity of snack foods consumed. It is possible that if the quantity or portion size of snack foods were measured, impression management effects may have been apparent in that participants consumed less than normal. In this case, the findings would indicate that impression management does not restrict food intake altogether, but instead serves to limit the portion size of snack foods. Therefore, social cues may indeed operate in both directions, both facilitating and inhibiting food intake.

Consistent with previous research examining social facilitation effects in different food types (Clendenen, Herman & Polivy, 1994; Hetherington, 2006), this study found the presence of others eating to be significantly associated with the consumption of both high-energy and low-energy snack foods. Interestingly, an assessment report was more than 5 times more likely to be a high-energy snack report than a random prompt, but less than twice as likely to be a low-energy snack report than a random prompt. Therefore, findings from this study support the idea that social facilitation effects may be greater for high-energy snack foods (Hetherington, 2006). This may be because highly palatable snacks are often associated with celebration and eaten in social settings.

Momentary Nature of Social Norms

A number of recent studies have contributed to our understanding of how social norms operate to affect consumption decisions (Herman et al., 2003; Higgs, 2016; Robinson, Benwell & Higgs, 2013). This study however was the first to

examine the influence of social norms on snacking behaviour in near real-time. Ratings of momentary norms (approval and encouragement) significantly differed both between and within participants. This means that participants differed with regards to their levels of momentary norms, but more importantly, significantly varied within in their individual perceptions of norms as well. Therefore, each participant perceived varying levels of approval and encouragement when encountering the presence of others eating, indicating that social norms change from moment to moment and vary in different social situations.

This finding was consistent with previous research of social norms in general, which suggest that norms differentially predict behaviour depending on the social context (Cooke & French 2011; Salvy, Romero, Paluch & Epstein, 2007). For example, Cooke and French (2011) found that students' perceptions of normative drinking behaviour differentially predicted intentions to binge drink when asked in two different social contexts. Students' mean scores of intentions to binge drink were significantly higher when asked in a campus bar compared to when asked in a library. Therefore, students' perceived binge drinking to be significantly more appropriate when they were asked in a drinking environment than when asked in a non drinking environment. Similarly, our data suggests that perceptions of norms of appropriate snacking vary in different contexts. Specifically, different social situations, such as the presence or absence of others eating, alters norm perceptions and in turn the extent of consumption. Therefore, findings from this study support the idea that norms are situationally variable, and indicate that ignoring social context, or perceiving norms as stable, may result in an underestimation of the impact of social norms on snacking.

Momentary Social Norms Mediate the Effects of Social Cues on Snacking

Decades of research have investigated the effects of social cues on eating behaviour, and a range of explanations have been put forth to explain why social influences are so pervasive in steering people's eating patterns. To date, the most prominent explanation of these effects is the normative perspective (Herman, et al., 2003), which suggests that people's beliefs about what is appropriate to eat in a given social context, are the principle regulatory influence guiding eating behaviour. Specifically, the presence and behaviour of others guides individuals' eating behaviour in predictable and norm based patterns. Consistent with the normative perspective, this study found that the effects of social cues (observing others eating) can be partially accounted for by the operation of social norms. In accordance with our second hypothesis, both of our measures of momentary social norms (approval and encouragement) partially mediated the effects of observing others eat on all three snacking conditions (total, high-energy snacking and low-energy snacking). Therefore, being in the presence of others eating predicted ratings of approval and encouragement, which were associated with an increased likelihood of snacking.

Notably, participants reported greater increase in mean encouragement scores than approval scores when they were in the presence of others eating. This might have been the case as there are few situations in which snacking is completely inappropriate or disapproved of, resulting in consistently higher approval scores. Therefore, there may have been a ceiling effect for approval scores whereby they did not increase to the extent that encouragement scores did. However, approval and encouragement were measures on different scales, therefore, one unit increase in approval may not equate to one unit increase in encouragement.

Explaining the Power of Social Eating Norms

An extensive literature suggests that there are two main reasons as to why social eating norms are followed and have such a powerful influence on our eating. Firstly, following a social eating norm is suggested to enhance social affiliation with one's eating companion (Higgs, 2016). Secondly, follow an eating norm allows an individual to eat the way they perceive is correct, referred to as the uncertainty-reduction hypothesis. Numerous studies have examined these two potential motives of norm following.

In line with the motive of affiliation, Hermans, Engels, Larsen and Herman (2009) suggested that norm following is affected by the the quality of social interactions. In this study, participants dined with either a friendly confederate or an unsociable confederate. Interestingly, results indicated that participants were less likely to model the eating behaviour of the friendly confederate than the unsociable confederate. Hermans et al. (2009) explained this finding by suggesting that individuals are less likely to follow the social eating norms inferred by others when they are already feel accepted by their eating companion. Indeed, when dining with a friendly social eating partner, participants may not have felt the need to affiliate and integrate themselves by following their eating behaviour. This theory was experimentally tested by manipulating participants' feelings of social acceptance prior to eating (Robinson, Tobias, Shaw, Freeman & Higgs, 2011). Results indicated that participants who were primed to feel socially accepted prior to eating, modelled the eating behaviour of the confederate to a lesser extent than when they were not primed. Together, these studies suggest that individuals follow eating norms to gain social acceptance and to socially affiliate with their eating companions (Higgs, 2016).

Other researchers have questioned affiliation as a motive of norm following, suggesting that we do not follow the norms of appropriate eating to gain social acceptance from others but to eat the 'correct' way. Evidence from this uncertainty-reduction hypothesis comes from laboratory studies in which participants were unaware of the centrality of social influence to the study. In these studies, participants were led to believe that participants before them had eaten either small or large quantities of food by secretly exposing them to environmental cues that indicated how previous participants had eaten (the Remote-Confederate Paradigm). For example, Prinsen et al. (2013) observed participants' eating patterns individually in the waiting room of their study. The presence of empty wrappers next to a bowl of chocolates was manipulated to indicated that participants in the same situation had previously eaten chocolates. Results indicated that participants ate more chocolates when the apparent norm was that others had eaten them too (as the presence of empty wrappers indicated), than when there was no such visible evidence.

These findings were supported by a meta-analysis of 15 experimental studies that manipulated the presence of eating norms (Robinson, Thomas, Aveyard & Higgs, 2013). Meta-analysis revealed that normative information indicating that past participants had consumed large quantities of food was associated with increased consumption. Likewise, normative information suggesting previous participants had eaten small quantities was associated with decreased consumption (both effect sizes were moderate). These findings revealed that individuals still model the eating behaviour of others even when they are alone and unaware that their eating is being observed and evaluated. Indeed, even when alone, participants used information about the consumption of others to adhere to the norms of appropriate eating. These findings suggest that individuals may not follow eating norms to promote affiliation

as previously suggested, but to eat in a way they perceive is appropriate and socially acceptable (Burger et al., 2010; Cruwys et al., 2015).

It is clear that in different situations, social norms about appropriate eating are followed for different reasons. While originally thought to promote affiliation, remote-confederate designs suggest that uncertainty-reduction may be a greater motive. These two motives are usually conceptualised as independent and competing explanations. However, Higgs (2016) suggested that both motives are important in understanding why normative eating behaviours are followed, and proposed that affiliation and uncertainty-reduction may actually be interdependent motives. According to Higgs (2016), norm following is underpinned by concerns of both affiliation and correctness, that are motivated by evolutionary fitness. Specifically, following eating norms is suggested to be an adaptive behaviour that increases the likelihood of eating safe and healthy foods.

It has also been suggested that the pervasiveness of social norms in influencing eating behaviour can be explained by the social judgements they are associated with (Higgs, 2016). Indeed, the act of following or not following a prevailing social norm is associated with emotional consequences. Following a norm may result in positive consequences for an individual, such as feelings of belongingness, acceptance and social approval. However, not following a norm is known to be socially sanctioned (Fehr & Fischbacher, 2004). Therefore, people may follow social eating norms to avoid negative social consequences such as embarrassment or disapproval that may result from eating excessively (Herman et al., 2003; Higgs, 2016). In line with these findings, there are a number of reasons as to why perceptions of norms were associated with snacking in this study. Participants may have followed the norms of appropriate eating to affiliate with their

eating companions or those eating around them. Additionally, by following perceived eating norms, participants may have ensured they were eating correctly and safely. Finally, the effects of social norms may have been so powerful because deviations from norms are strongly discouraged while following norms is associated with approval and positive judgements. It is possible that all explanations may have related to our findings.

Strengths and Limitations

A key strength of this study is that it was the first to consider the effects of social norms on snacking, at the time individuals decided to eat, using EMA technology. In general, EMA measures present a number of strengths over recall-based methods of dietary intake, such as food diaries and questionnaires, as they measure eating and exposure to social and environmental cues in near real-time (Thomas, Doshi, Crosby, & Lowe, 2011). Therefore, EMA overcomes the limitations of traditional methodologies, such as memory biases and under reporting of food intake. Secondly, as EMA procedures are performed in a real world setting, they are a more ecologically valid manner than laboratory studies (Shiffman et al., 2008). Specifically, capturing the influence of social cues in real world settings allows for a more detailed examination of the effects of social norms on snacking. Further, EMA procedures present a less threatening means of assessing food intake than traditional methodologies, as participants do not have to recount every eating event individually, thus reducing the potential of social desirability biases.

Importantly, there were some limitations that may have impacted on the interpretation of the results. Firstly, as EMA relies on self-report measures of snacking, our assessments of participants' snack intake were not objectively verified. However, when studying everyday eating behaviour, self-report measures are

considerably more practical than objective measures. Secondly, due to the inherent burden of EMA measures on participants, we were limited to a relatively small sample size (*N*=61), which may have impacted the generalizability of our results. However, due to the intensive and longitudinal nature of EMA methods, a large number of observations were able to be obtained within this study which improved the generalizability of findings. Further, previous simulation studies (Maas & Hox, 2005) suggest that even smaller sample sizes are adequate to obtain reliable estimates of within-subjects effects. Another important consideration in terms of generalizability is the demographic characteristics of our sample, which was overwhelming Caucasian, female and university educated. Given that individuals of higher education generally make healthier food choices (Allen, Taylor & Kiper, 2007; Pechey & Monsivais, 2016), and that eating varies by social and cultural context (Holm et al., 2016) our results may be biased to capturing the eating habits of a select group of individuals. Future replication studies should aim for a more representative sample, ideally with more members of the general community.

Further, in light of previous research findings by Shiffman et al. (2008) which indicate that compliance with random prompts systematically varies, it is possible that certain situations render individuals to be less compliant with EMA monitoring than others. For example, participants may be less willing or able to answer random prompts or to log food intake when interacting with others or socialising. Given this potential, our results may have captured a biased subset of snack reports and random prompts.

Our results may have also been compromised by assuming that assessment reports only varied within participants (i.e., a 2-level model). As it has been suggested that individuals' eating patterns, and in particularly snacking, may differ

depending on which day of the week it is (Larson, Story, Eisenberg & Neumark-Sztainer, 2016), we may have also assumed that assessment reports vary within days of the week. Therefore, the interpretation of our results may have been limited by assuming a two-level model that did not account for the potential variation in days of the week. However, using a two level model did allow for our results to be consistent and comparable with previous publications.

Implications

This study was the first to examine the influence of social norms from a real-time perspective. It shows that people take the norms of appropriate eating into account in food decisions as they make them. Specifically, perceived approval and encouragement when in the presence of others eating, was significantly associated with an increased likelihood of snacking. Our findings therefore have potential implications for both theoretical accounts of normative behaviour and health interventions aimed at changing dietary behaviour.

In terms of theoretical implications, our momentary norm findings indicate that norms are situation specific and are often change in the moment. Therefore, previous research and theories that have conceptualized norms as stable may be underestimating the importance of normative influence on eating behaviour. Secondly, in regards to our measures of momentary norms, it would be interesting for future research to examine the differences between perceived implicit or explicit approval and encouragement scores. Specifically, we propose that explicit encouragement may have the greatest association with changing eating behaviour, as it may be perceived as a direct request of compliance. In line with previous research demonstrating the powerful effects of conformity on behaviour (Ache, 1952; Xie et

al., 2016), individuals may be more inclined to change their eating behaviour when explicitly encouraged to do so.

In terms of health interventions, findings from this study support the use of social norm messages (specifically injunctive norm messages) in health interventions aimed at changing dietary behaviour. In light of recent findings that have highlighted the ineffectiveness of traditional health intervention in changing dietary behaviour, normative information has become increasingly used as a primary tool for changing eating habits. For example, traditional interventions have widely publicized the health benefits of eating healthy foods. Despite this, consumption of fruits and vegetables remain below recommended guidelines in Australia (Hendrie et al, 2016). Alternatively, the use of social norm messages relies on the idea that individuals use their perceptions of peer norms as a standard against which to compare their own behaviour.

Recently, descriptive social norm message that indicate that other people are eating healthily have been used to target fruit and vegetable intake in a student population (Mollen, Rimal, Ruiter, & Kok, 2013). Students in the descriptive social norm condition received messages informing them that most student eats five servings of fruit and vegetables per day. In contrast, students in the health condition received health messages informing them that their general health may be improved by eating nutritious foods such as fruits and vegetable. Results indicated that after reading a descriptive social norm message, students' mean intake of fruit and vegetables consumed was significantly greater than after exposure to a traditional health message. Further, norm messages were associated with a reduction in total calories consumed. Therefore, results indicated that descriptive social norm

messages were more influential than health messages in increasing healthier eating among students.

The use of injunctive social norm messages (behaviours that are perceived as being approved by others) in health interventions has received mixed findings (Mollen et al., 2013; Burger et al., 2010). However, findings from this study indicate that perceived approval and encouragement (two measures of injunctive norms) are significantly associated with an increased likelihood of snacking. Therefore, incorporating injunctive social norm messages that convey that healthier eating is approved of and encouraged may increase the intake of healthier snack foods. As healthy eating is generally approved of in society, accurate injunctive messages should be effectively implemented in an intervention setting.

Importantly, future research may examine the extend to which participants recognise the influence of social norms on their snacking behaviour. Recent findings indicate that people tend to explain their eating habits in terms of hunger levels, tastiness of foods or financial costs of different food types (Vartanian, Herman & Wansink, 2008). Interestingly, one study has found that individuals may confuse these physiological and social motives of eating (Vartanian, Spanos, Herman and Polivy (In Press). Vartanian et al. (In Press), asked participants to rate the extent to which their eating was influenced by internal cues (hunger levels) or social cues (how much others ate). Results indicated that participants were generally inaccurate in recognising the factors that influenced their eating, often confusing the two attributing factors. Individuals' recognition of the influence of momentary social norms on snacking behaviour is yet to be examined. Such findings may contribute to our understanding of how individuals regulate their eating behaviour and whether normative influences occur outside of conscious awareness (Hermans et al., 2012).

Indeed, if individuals are unaware that social norms influence their eating behaviour, it may be difficult to avoid overeating in an increasingly obesogenic environment.

Conclusion

Social norms are one of the most powerful, yet least visible influences on human behaviour (Sherif, 1936). Accordingly, one reason why other people influence our eating is because they provide a social norm of appropriate behaviour that guides food consumption. Our real-time data extends this idea to suggest that perceptions of normative eating behaviour are momentary and that different situations and contexts evoke the implicit creation of momentary eating (snacking) norms. We conclude that future normative theories and health interventions utilizing social norm messages should recognise the momentary nature of social norms in influencing people's eating decisions.

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Appendix A

Ethics approval letter

Social Science Ethics Officer
Private Bag 01 Hobart
Tasmania 7001 Australia
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Katherine.Shaw@utas.edu.au

HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

1 April 2016
Dr Benjamin Schuez
Division of Psychology
University of Tasmania
Student Researcher: Thalia Papadakis

Sent via email

Dear Dr Schuez

Re: MINIMAL RISK ETHICS APPLICATION APPROVAL Ethics Ref: **H0015647 - Individual, situational and normative predictors of food choices**

We are pleased to advise that acting on a mandate from the Tasmania Social Sciences HREC, the Chair of the committee considered and approved the above project on 31 March 2016.

This approval constitutes ethical clearance by the Tasmania Social Sciences Human Research Ethics Committee. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities is required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

Please note that this approval is for four years and is conditional upon receipt of an annual Progress Report. Ethics approval for this project will lapse if a Progress Report is not submitted.

The following conditions apply to this approval. Failure to abide by these conditions may result in suspension or discontinuation of approval.

1. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval, to ensure the project is conducted as approved by the Ethics Committee, and to notify the Committee if any investigators are added to, or cease involvement with, the project.

SERVICES

1. Complaints: If any complaints are received or ethical issues arise during the course of the project, investigators should advise the Executive Officer of the Ethics Committee on 03 6226 7479 or human.ethics@utas.edu.au.

2. Incidents or adverse effects: Investigators should notify the Ethics Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

3. Amendments to Project: Modifications to the project must not proceed until approval is obtained from the Ethics Committee. Please submit an Amendment Form (available on our website) to notify the Ethics Committee of the proposed modifications.

4. Annual Report: Continued approval for this project is dependent on the submission of a Progress Report by the anniversary date of your approval. You will be sent a courtesy reminder closer to this date. **Failure to submit a Progress Report will mean that ethics approval for this project will lapse.**

5. Final Report: A Final Report and a copy of any published material arising from the project, either in full or abstract, must be provided at the end of the project.

Yours sincerely

Katherine Shaw Executive Officer Tasmania Social Sciences HREC

Appendix B

Baseline survey

Confidential

Baseline Questions

[firstname], please complete the survey below.

Thank you!

Gender

- ◯ Male
- ◯ Female

What is your ethnicity / ancestry?

- ☐ Caucasian / European
- ☐ Aboriginal
- ☐ Torres Strait Islander
- ☐ Asian
- ☐ Other

(Please choose all that apply)

Which ethnicity?

_____

(Please specify)

What is the highest level of education that you have completed?

- ◯ Year 10 or less
- ◯ Year 12 (or equivalent)
- ◯ Some University
- ◯ Graduated University
- ◯ Graduated TAFE
- ◯ No answer

What diet are you attempting?

_____

What is the reason you are dieting?

- ◯ To lose weight
- ◯ To maintain weight
- ◯ Other

What is the other reason you are dieting?

_____

Confidential

Do you do your own cooking/meal preparation at home? Choose one of the following answers:

- ◯ Rarely or none of the time
- ◯ Some of the time (1 - 2 days a week)
- ◯ Much of the time (3 - 4 days a week)
- ◯ Most of the time (5 - 7 days a week)

How often do you 'eat out' (e.g. at a restaurant / cafe etc.)? Choose one of the following answers:

- ◯ Rarely or none of the time
- ◯ Some of the time (1 - 2 days a week)
- ◯ Much of the time (3 - 4 days a week)
- ◯ Most of the time (5 - 7 days a week)

How often do you eat 'take away' or 'fast food' (e.g. McDonalds, Hungry Jacks, Subway)?

- ◯ Rarely or none of the time
- ◯ Some of the time (1 - 2 days per week)
- ◯ Much of the time (3 - 4 days per week)
- ◯ Most of the time (5 - 7 days per week)

Please select the option from the following scale that best describes you:

	Very true for me	Somewhat true for me	Somewhat false for me	Very false for me
When I'm doing well at something I love to keep at it.	○	○	○	○
When I get something I want, I feel excited and energized.	○	○	○	○
When I see an opportunity for something I like I get excited right away.	○	○	○	○
When good things happen to me, it affects me strongly	○	○	○	○
I feel worried when I think I have done poorly at something important.	○	○	○	○
It would excite me to win a contest.	○	○	○	○

For each of the following statements, please indicate if you felt this way during the PAST WEEK.

	Rarely or none of the time (less than 1 day)	Some of the time (1-2 days)	Much of the time (3-4 days)	Most of the time (5-7 days)
I was bothered by things that usually don't bother me.	○	○	○	○
I had trouble keeping my mind on what I was doing.	○	○	○	○
I felt depressed.	○	○	○	○
I felt that everything I did was an effort.	○	○	○	○
My sleep was restless.	○	○	○	○

For each of the following statements, please indicate if you felt this way during the PAST WEEK.

	Rarely or none of the time (less than 1 day)	Some of the time (1-2 days)	Much of the time (3-4 days)	Most of the time (5-7 days)
I was happy.	○	○	○	○
I felt lonely.	○	○	○	○
I felt hopeful about the future.	○	○	○	○
I felt fearful.	○	○	○	○
I could not get going.	○	○	○	○

Please indicate how much you agree with the following statements.

	I don't agree	I agree a little	I agree somewhat	I agree quite a bit	I strongly agree
I find myself thinking about food even when I am not physically hungry.	○	○	○	○	○
I get more pleasure from eating than I do from almost anything else.	○	○	○	○	○
If I see or smell a food I like, I get a powerful urge to have some.	○	○	○	○	○
When I'm around a fattening food I love, its hard to stop myself from at least tasting it.	○	○	○	○	○
Its scary to think of the power that food has over me.	○	○	○	○	○
When I know a delicious food is available, its hard to stop myself from thinking about having some.	○	○	○	○	○
I love the taste of certain foods so much that I can't avoid eating them, even if they're bad for me.	○	○	○	○	○
Just before I taste a favourite food, I feel intense anticipation.	○	○	○	○	○

Please indicate the extent to which you agree that the following items describe you.

	I don't agree	I agree a little	I agree somewhat	I agree quite a bit	I strongly agree
When I eat delicious food, I focus a lot on how good it tastes.	○	○	○	○	○
Sometimes, when I'm doing everyday activities, I get an urge to eat "out of the blue" (for no apparent reason).	○	○	○	○	○
I think I enjoy eating a lot more than most other people.	○	○	○	○	○
Hearing someone describe a great meal makes me really want to have something to eat.	○	○	○	○	○
It seems like I have food on my mind a lot.	○	○	○	○	○
It is very important to me that the foods I eat are as delicious as possible.	○	○	○	○	○
Before I eat a favourite food, my mouth tends to fill with saliva.	○	○	○	○	○

The next questions ask about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:
- Sweets like ice cream, chocolate, donuts, cookies, cake ,candy, ice cream;
- Starches like white bread, rools, pasta and rice;
- Salty snacks like chips, pretzels and crackers;
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza and french fries;
- Sugary drinks like soft drinks, red bull.
When the following questions ask about 'certain foods', please think of ANY foods similar to those listed above, or any other foods you have had a problem with in the past year.

	Never	Once a month	2 - 4 times a month	2 - 3 times a week	4 or more times a week, or daily
I find that when I start eating certain foods, I end up eating much more than planned.	○	○	○	○	○
I find myself continuing to consume certain foods, even when I am no longer hungry.	○	○	○	○	○
I eat to the point where I feel physically ill.	○	○	○	○	○
Not eating certain types of food, or cutting down on certain types of food, is something that I worry about.	○	○	○	○	○

The next questions ask about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:
- Sweets like ice cream, chocolate, donuts, cookies, cake ,candy, ice cream;
- Starches like white bread, rools, pasta and rice;
- Salty snacks like chips, pretzels and crackers;
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza and french fries;
- Sugary drinks like soft drinks, red bull.
When the following questions ask about 'certain foods', please think of ANY foods similar to those listed above, or any other foods you have had a problem with in the past year.

	Never	Once a month	2 - 4 times a month	2 - 3 times a week	4 or more times a week, or daily
I spend a lot of time feeling sluggish or fatigued from overeating.	○	○	○	○	○
I find myself constantly eating certain foods throughout the day.	○	○	○	○	○
I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase certain foods, even though I have other options available to me at home.	○	○	○	○	○

The next questions ask about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:
- Sweets like ice cream, chocolate, donuts, cookies, cake ,candy, ice cream;
- Starches like white bread, rools, pasta and rice;
- Salty snacks like chips, pretzels and crackers;
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza and french fries;
- Sugary drinks like soft drinks, red bull.
When the following questions ask about 'certain foods', please think of ANY foods similar to those listed above, or any other foods you have had a problem with in the past year.

	Never	Once a month	2 - 4 times a month	2 - 3 times a week	4 or more times a week, or daily
There have been times when I've consumed certain foods so often or in large quantities, that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or activities that I enjoy.	○	○	○	○	○
There have been times when I've avoided professional or social situations where certain foods are available, because I was afraid I would overeat.	○	○	○	○	○
There have been times when I've avoided professional or social situations because I was not about to consume certain foods there.	○	○	○	○	○

The next questions ask about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:
- Sweets like ice cream, chocolate, donuts, cookies, cake ,candy, ice cream;
- Starches like white bread, rools, pasta and rice;
- Salty snacks like chips, pretzels and crackers;
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza and french fries;
- Sugary drinks like soft drinks, red bull.
When the following questions ask about 'certain foods', please think of ANY foods similar to those listed above, or any other foods you have had a problem with in the past year.

	Never	Once a month	2 - 4 times a month	2 - 3 times a week	4 or more times a week, or daily
I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods. (Please do NOT include withdrawal sypmtoms caused by cutting down caffeinated beverages such as soft drink, coffee, tea, energy drinks etc.)	○	○	○	○	○
I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them.	○	○	○	○	○

The next questions ask about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:
- Sweets like ice cream, chocolate, donuts, cookies, cake ,candy, ice cream;
- Starches like white bread, rools, pasta and rice;
- Salty snacks like chips, pretzels and crackers;
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza and french fries;
- Sugary drinks like soft drinks, red bull.
When the following questions ask about 'certain foods', please think of ANY foods similar to those listed above, or any other foods you have had a problem with in the past year.

	Never	Once a month	2 - 4 times a month	2 - 3 times a week	4 or more times a week, or daily
My behaviour with respect to food and eating causes significant distress.	○	○	○	○	○
I experience significant problems in my ability to function effectively (daily routine, job, school, social activities, family activities, health difficulties) because of food and eating.	○	○	○	○	○

Please select the option from the following scale that best describes how often you have felt/behaved this way in the last 12 months.

	No	Yes
My food consumption has caused significant psychological problems such as depression, self loathing, anxiety, or guilt.	○	○
My food consumption has caused significant physical problems or made a physical problem worse.	○	○
I kept consuming the same types of food or same amount of food even though I was having emotional and/or physical problems.	○	○
Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions, or increased pleasure.	○	○
I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to.	○	○
I want to cut down or stop eating certain kinds of food.	○	○

Please select the option from the following scale that best describes how often you have felt/behaved this way in the last 12 months:

	None	One time	Two times	Three times	Four times	Five or more times
How many times in the past year did you try to cut down or stop eating certain foods altogether?	○	○	○	○	○	○

The next two questions relate to healthy food choices - this means choosing, for example, a low-calorie option (e.g., an apple) over a high-calorie option (e.g., a chocolate bar) when you decide to have a meal or snack. Imagine yourself in that situation, and think about the outcomes of your food choice.

If you were to experience COSTS from making a healthy food choice, WHEN do you think you would notice them?

- ○ When I am thinking about whether or not to make a healthy food choice.
- ○ When I make the decision to make a healthy food choice.
- ○ While I am getting ready to make a healthy food choice.
- ○ While I am making a healthy food choice.
- ○ After making a healthy food choice once.
- ○ After making healthy food choices regularly for a week.
- ○ After making healthy food choices regularly for a year.
- ○ After making healthy food choices regularly for several years.
- ○ After making healthy food choices regularly for several decades.

f you were to experience BENEFITS from making a healthy food choice, WEN do you think you would notice them?

- ○ When I am thinking about whether or not to make a healthy food choice.
- ○ When I make the decision to make a healthy food choice.
- ○ While I am getting ready to make a healthy food choice.
- ○ While I am making a healthy food choice.
- ○ After making a healthy food choice once.
- ○ After making healthy food choices regularly for a week.
- ○ After making healthy food choices regularly for a year.
- ○ After making healthy food choices regularly for several years.
- ○ After making healthy food choices regularly for several decades.

The next questions are about whether you have intentions or plans to change your diet in the future.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I intend to make more healthy food choices.	○	○	○	○	○
I am confident that I could make more healthy food choices even if it was difficult.	○	○	○	○	○
I have made a detailed plan on when, where and how to implement more healthy food choices.	○	○	○	○	○
I have made a detailed plan on how to make healthy food choices if something gets in the way.	○	○	○	○	○

The next questions are about yourself. Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

	1 - Not at all	2	3	4	5 - Very much
I am good at resisting temptation.	○	○	○	○	○
I have a hard time breaking bad habits	○	○	○	○	○
I am lazy.	○	○	○	○	○
I say inappropriate things.	○	○	○	○	○
I do certain things that are bad for me if they are fun.	○	○	○	○	○
I refuse things that are bad for me.	○	○	○	○	○
I wish I had more self-discipline.	○	○	○	○	○

The next questions are about yourself. Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

	1 - Not at all	2	3	4	5 - Very much
People would say that I have iron self-discipline.	○	○	○	○	○
Pleasure and fun sometimes keep me from getting work done.	○	○	○	○	○
I have trouble concentrating.	○	○	○	○	○
I am able to work effectively towards long-term goals.	○	○	○	○	○
Sometimes I can't stop myself from doing something, even if I know it is wrong.	○	○	○	○	○
I often act without thinking through all the alternatives.	○	○	○	○	○

The next questions are about how you typically deal with tasks.

	Not at all true	Barely true	Somewhat true	Completely true
I can concentrate on one activity for a long time if necessary.	○	○	○	○
When I am distracted from an activity, I don't have any problem coming back to the topic quickly.	○	○	○	○
If an activity arouses my feelings too much, I can calm myself down so that I can continue with the activity soon.	○	○	○	○
If an activity requires a problem-oriented attitude, I can control my feelings.	○	○	○	○
It is difficult for me to suppress thoughts that interfere with what I need to do.	○	○	○	○

The next questions are about how you typically deal with tasks.

	Not at all true	Barely true	Somewhat true	Completely true
I can control my thoughts from distracting me from the task at hand.	○	○	○	○
When I worry about something, I cannot concentrate on an activity.	○	○	○	○
After an interruption, I don't have any problem resuming my concentrated style of working.	○	○	○	○
I usually have a whole bunch of thoughts and feelings that interfere with my ability to work in a focused way.	○	○	○	○
I stay focused on my goal and don't allow anything to distract me from my plan of action.	○	○	○	○

Most health organisations suggest that a healthy diet is one that consists of at least five portions (servings of fruit and vegetables per day.

	0 out of 7	1 out of 7	2 out of 7	3 out of 7	4 out of 7	5 out of 7	6 out of 7	7 out of 7
On how many days during the last week have you eaten at least five portions (servings) of fruit and vegetables?	○	○	○	○	○	○	○	○

Appendix C

Information sheet

Private Bag 30 Hobart
Tasmania 7001 Australia
Phone (03) 6226 7471 Fax (03) 6226 7471
Email Benjamin.schuez@utas.edu.au

SCHOOL OF MEDICINE

PARTICIPANT INFORMATION SHEET

Individual and situational predictors of food choices in people

1. Invitation

You are invited to participate in a research study investigating the drivers (''predictors'') and consequences of eating. The study is conducted by Dr Benjamin Schüz, Dr Stuart Ferguson and Thalia Papadakis from the School of Medicine of the University of Tasmania.

2. 'What is the purpose of this study?'

The purpose of the study is to examine eating behaviour in people with a normal – high BMI from the ''input'' perspective. This means that we want to examine the drivers and consequences of eating, in particular the consumption of energy-dense food. Data will be gathered on the individual (e.g., craving, hunger, mood), as well as social and situational (e.g., location, company) antecedents of eating, as well as how people feel after eating. Results from this research have the potential to influence the development of more efficacious treatments to support people with overweight and obesity in maintaining a healthy diet.

3. 'Why have I been invited to participate in this study?'

You are eligible to participate in this study if you are over 18, have never been diagnosed with an eating disorder, have a Body Mass Index (BMI) between 18 and 40, are not currently dieting and are interested in contributing to research about eating patterns.

4. What will I be asked to do?

If you choose to participate in this study, you will be required to take part in 14 days of monitoring (explained below).

While in the study, you will be monitoring your eating / drinking patterns and your feelings as well as experiences as you go about your daily life. To do this, we will supply you with a simple to use hand-held computer – which looks very much like a smartphone. You will need to return this computer at the end of the study. You will be asked to carry this computer with you at all times for the duration of the 14 day study.

You will need to carry the device with you wherever you go at all days of the study and record and photograph each time you consume any food or drink. Some of these recordings will be randomly followed up by a brief assessment consisting of questions asking about the social, emotional, and situational environment of where you had food or a drink. You will also be asked to complete 4-5 assessments at random time points during the day. Each assessment will only take about 1-2 minutes to complete. During these assessments, the device will also automatically record the location you are at. We will provide you with training on how to use the device and will happily answer any questions you might have regarding participating in this study.

Participating in this study will also require you to visit the University of Tasmania up to three times for short study visits. One initial visit to enrol (approximately 45 minutes), and for two short (approximately 15 minutes) visits; the first around day three of participating, and a final visit on day 14 of the study. During the enrolment visit, you will receive training on how to use device and you will be asked to complete some baseline surveys to help us gather background information on your current and previous eating behaviour. At visit 2, three days into the study, the data will be downloaded from your devices and any additional questions you might have will be answered. During the final visit after 21 days, you will return the study device and will receive some debriefing regarding your experiences during the study. You will also be reimbursed $50 for your time and contribution to the research at this visit.

It is important that you understand that your involvement in this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you in you decide not to participate.

All information will be treated highly confidential, and your name or any identifying information will not be used in any publication arising from this research. All data will be analysed without identifying information so that at no time individual participants can be identified.

The research data will be kept in a locked file cabinet (hard copies) at the School of Medicine, and all electronic data will be kept on a password-protected computer. In accordance with National Ethics Guidelines, hard copy data will be kept for five (5) years before being destroyed. Electronic data will be securely stored until it is no longer needed.

5. Are there any possible benefits from participation in this study?

It is possible that the monitoring technology used in this study will help you learn more about your individual eating and/or drinking behaviour. Furthermore, the information we gather may be beneficial for other people by contributing to the development of future dietary management interventions.

6. Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study.

7. How will the results of the study be published?

When the study has been completed, the main outcomes will be published on the University of Tasmania's website and in scientific journal articles. We will also send you results of the study to the email address you have given us.

Your name will not be used in any publication arising out of the research.

8. What if I have questions about this study?

If you would like to discuss any aspect of this study please feel free to contact our team on (03) 6226 7471. We are happy to discuss any aspect of the research with you. You are welcome to contact us to discuss any issue relating to the research study.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 2763 or email human.ethics@utas.edu.au. The Executive Officer is the

person nominated to receive complaints from research participants. Please quote ethics reference number H0014439.

Thank you for taking the time to consider this study.

If you wish to take part in it, please sign the attached consent form.

This information sheet is for you to keep.

Appendix D

Consent form

Private Bag 30 Hobart
Tasmania 7001 Australia
Phone (03) 6226 7471 Fax (03) 6226 7471
Email Benjamin.schuez@utas.edu.au

School of Medicine, Psychology

UTAS

UNIVERSITY OF TASMANIA

CONSENT FORM

Individual and situational predictors of food choices

1. I acknowledge that the nature, purpose and contemplated effects of the project so far as it affects me, have been fully explained to my satisfaction by the study staff member and my consent is given voluntarily.
2. The details of the research have also been explained to me, including the anticipated length of time it will take, the frequency with which the assessments will be performed. I understand that my participation involves:

    - Fourteen (14) days of monitoring (explained below). While in the study, I will be asked to monitor my eating and drinking behaviour and associated questions using a hand-held computer. I understand that my participation involves carrying this device with me at all times for the duration of the 14 day study.
    - Three study visits to the University of Tasmania campus, each of which will take between 15 and 45 minutes to complete;
    - The completion of a baseline questionnaire (assessing current diet, diabetes illness perceptions, demographics, and mood questionnaires) during the initial visit.
    - Being reimbursed $50 upon completion of the third visit and return of device to compensate for my time.

3. I understand that there are no risks anticipated from my involvement in this research.

4. I understand that my involvement in the project will not affect my relationship with my medical advisers in their management of my health. I also understand that I am free to withdraw from the project at any stage and any of my data/specimens that have been collected. My withdrawal will not affect my legal rights, my medical care or my relationship with the hospital or my doctors.

5. I understand that I will be given a signed copy of the participant information sheet and consent form. I am not giving up my legal rights by signing this consent form.

6. I understand that all research data will be securely stored on the University of Tasmania premises for at least five years and will be destroyed when no longer needed.

7. I understand that research data gathered from me may be published, provided that I cannot be identified as a person.

8. I understand that the researchers will maintain my identity confidential and that any information I supply to the researchers will be used only for the purposes of this research.

9. I understand that the research will be conducted in accordance with the latest versions of the *National Statement on Ethical Conduct in Human Research 2007* and applicable privacy laws.

10. Any questions that I have asked have been answered to my satisfaction.

Name of participant

Email address (if we need to contact you):

Signature of participant

Date

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

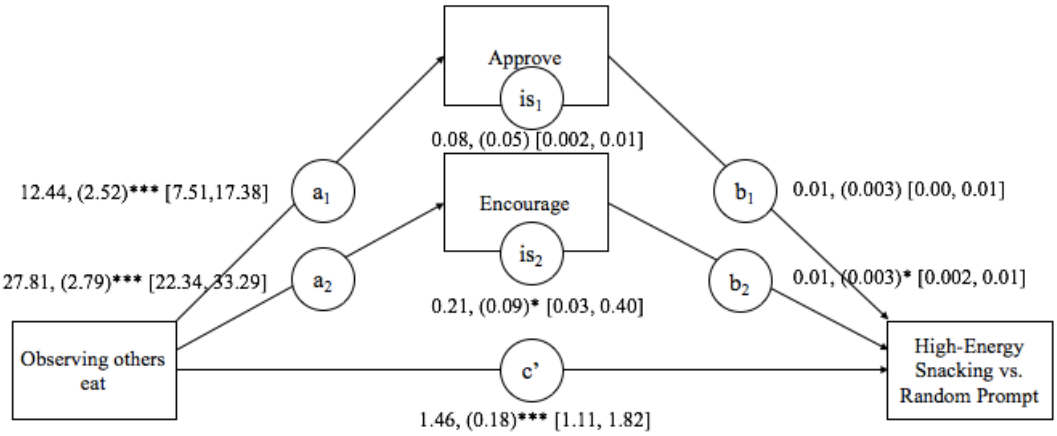
Name of investigator

Signature of investigator

Date

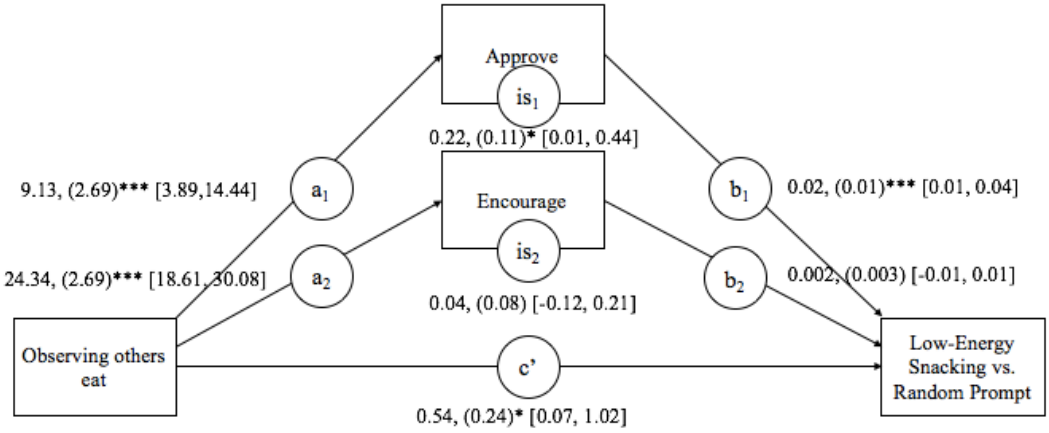
Appendix E

Mediation models



Unstandardized path coefficients for the mediation model predicting high-energy snacking from observing others eat, as mediated by approval and encouragement (momentary norms). Standard errors in parentheses and 95% CIs in brackets.

Note * $p < .05$, *** $p = .001$.



Unstandardized path coefficients for the mediation model predicting low-energy snacking from observing others eat, as mediated by approval and encouragement (momentary norms). Standard errors in parentheses and 95% CIs in brackets.

Note * $p < .05$, *** $p = .001$.

Appendix F

EMA program questions

Questionnaire: Wakeup Report

Q#	Type of Data	Text	Response type	Response options
1	Question	Good Morning! How long ago did you wake up?	Push Button (pick one)	<15 mins, 15 - 30 mins, 30 - 60 mins, >60 mins
	Instruction	The following questions refer to events occurring since the last morning report:		
2	Question	Have you consumed any meals but NOT yet entered? If yes, how many?	Spinner	0-10+
3	Question	Have you consumed any snacks but NOT yet entered? If yes, how many?	Spinner	0-10+
4	Question	Have you consumed any drinks but NOT yet entered? If yes, how many?	Spinner	0-10+
5	Question	Do you currently crave food?	Slider	0-100 (with No!!-Yes!! anchors)

Main Menu: Food Log

Q#	Type of Data	Text	Response type	Response options	Notes / Skip Patterns
0	GPS				GPS location of participants at time of log start
0	Photo				Participants take photograph of their food
2	Question	Consumed a drink with your meal?	Push Button (pick one)	Yes, No	
3	Question	What type of drink	Check Box (all that apply)	Coffee, Tea, Milk, Alcohol, Energy drink, Normal soft drink / fizzy drink, Calorie-reduced soft drink / fizzy drink, juice, water, other	Ask only if 5e=yes
4	Question	How many drinks in last 15 minutes?	Spinner	1-5+	Ask only if 6e=drinking alcohol
5	Question	Do you feel intoxicated/drunk?	Slider	0-100 (with No!!-Yes!! anchors)	Ask only if 6e=drinking alcohol
	Instruction	Remaining items refer to the situation where you first decided to eat			
	Header	FEELING:			
6	Question	Alert?	Slider	0-100 (with No!!-Yes!! anchors)	
7	Question	Angry/frustrated?	Slider	0-100 (with No!!-Yes!! anchors)	
8	Question	Bored?	Slider	0-100 (with No!!-Yes!! anchors)	
9	Question	Calm/relaxed?	Slider	0-100 (with No!!-Yes!! anchors)	
10	Question	Able to focus?	Slider	0-100 (with No!!-Yes!! anchors)	
11	Question	Happy?	Slider	0-100 (with No!!-Yes!! anchors)	

12	Question	Irritable?	Slider	0-100 (with No!!-Yes!! anchors)	
13	Question	Stressed?	Slider	0-100 (with No!!-Yes!! anchors)	
14	Question	Restless?	Slider	0-100 (with No!!-Yes!! anchors)	
15	Question	Sad?	Slider	0-100 (with No!!-Yes!! anchors)	
16	Question	Energy level?	Push Button (pick one)	Very low, Low, Moderate, High, Very high	
17	Question	Overall feeling?	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good	
	Header	WHEN YOU DECIDED TO EAT:			
18	Question	Location?	Push Button (pick one)	Home, Workplace, Other's home, Bar, Restaurant, Vehicle, Outside, Between Places, Other	
19	Question	Food available?	Check Box (all that apply, but see note)	None, Confectionary, Savoury, Dairy, Biscuits/cakes/pastries, Fast food, Other	Don't allow No + any other option
20	Question	From where you are NOW, can you walk in 5 min or see...	Check Box (all that apply, but see note)	1. Franchised Fast Food (Macca, Hungry Jack's, Subway,...) 2. Other Fast Food (Takeaway, Fish & Chips, ...) 3. Sit-down Restaurant 4. Supermarket (Coles, Woolworths, ...) 5. Smaller food Shop (Hill Street, fresco, ...) 6. Convenience Store 7. Specialty Food Shop (Baker, Butcher, Ethnic Food, ...) 8. Chemist or Bargain Shop	Don't allow Alone + any other option
21	Question	With others?	Check Box (all that apply, but see note)	Alone, Friends, Acquaintances, Family members, Co-workers, Romantic partner	Don't allow Alone + any other option
22	Question	People eating?	Check Box (all that apply, but see note)	No, In my group, In view	Don't allow No + any oth option
23	Question	Activities?	Check Box (all that apply)	Working/chores, Inactive/leisure, Interacting with others, Between activities, Other activities	
24	Question	Type of work?	Push Button (pick one)	Job, School, House/Personal, Other	Ask only if 25e=Working/chores
25	Question	Type of inactivity/leisure?	Push Button (pick one)	Media, Hanging out, Hobbies, Sports/Exercise, Reading, Waiting, Doing nothing, Other	Ask only if 25e=inactivity/leisure
26	Question	Type of interaction with others?	Push Button (pick one)	Socializing, For business, Household issues, Arguing, Other interaction	Ask only if 25e=interactir with others

27	Question	**Is it socially acceptable to eat right now?**	Slider	0-100 (with No!!-Yes!! anchors)
28	Question	**Do you think the people with you would approve of eating right now?**	Slider	0-100 (with No!!-Yes!! anchors)
29	Question	**Have the people with you right now encouraged you to eat?**	Slider	0-100 (with No!!-Yes!! anchors)

Questionnaire: Random Prompts

Q#	Type of Data	Text	Response type	Response options	Notes / Skip Patterns
	Instruction	ABOUT YOUR LAST FOOD/DRINK:			
1	Question	How long ago did the event occur?	Push Button (pick one)	0-10 mins, 10-30mins, 30-60 mins, 1-2hours, 2-3 hours, >3hours	
2	Question	Was the food/drink satisfying?	Slider	0-100 (with No!!-Yes!! anchors)	
3	Question	Was the food/drink enjoyable/pleasing?	Slider	0-100 (with No!!-Yes!! anchors)	
4	Question	How much did you consume?	Push Button (pick one)	More than usual, Same as usual, less than usual	
	Header	RIGHT NOW:			
5	Question	Alert?	Slider	0-100 (with No!!-Yes!! anchors)	
6	Question	Angry/frustrated?	Slider	0-100 (with No!!-Yes!! anchors)	
7	Question	Bored?	Slider	0-100 (with No!!-Yes!! anchors)	
8	Question	Calm/relaxed?	Slider	0-100 (with No!!-Yes!! anchors)	
9	Question	Able to focus?	Slider	0-100 (with No!!-Yes!! anchors)	
10	Question	Happy?	Slider	0-100 (with No!!-Yes!! anchors)	
11	Question	Irritable?	Slider	0-100 (with No!!-Yes!! anchors)	
12	Question	Stressed?	Slider	0-100 (with No!!-Yes!! anchors)	
13	Question	Restless?	Slider	0-100 (with No!!-Yes!! anchors)	
14	Question	Sad?	Slider	0-100 (with No!!-Yes!! anchors)	
15	Question	Energy level?	Push Button (pick one)	Very low, Low, Moderate, High, Very high	
16	Question	Overall feeling?	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good	
	Header	RIGHT NOW:			
17	Question	Location?	Push Button (pick one)	Home, Workplace, Other's home, Bar, Restaurant, Vehicle, Outside, Other	

18	Question	From where you are NOW, can you walk in 5 min or see...	Check Box (all that apply, but see note)	1. Franchised Fast Food (Macca, Hungry Jack's, Subway,...) 2. Other Fast Food (Takeaway, Fish & Chips, ...) 3. Sit-down Restaurant 4. Supermarket (Coles, Woolworths, ...) 5. Smaller food Shop (Hill Street, fresco, ...) 6. Convenience Store 7. Specialty Food Shop (Baker, Butcher, Ethnic Food, ...) 8. Chemist or Bargain Shop	Don't allow Alone + any other option
19	Question	Food available?	Check Box (all that apply, but see note)	Candy Bar, Chocolate, Other Confectionary, Chips, Cheese, Cracker, Fruit/Nuts, Dairy, Biscuits/cakes/pastries, Fast food, Other	Don't allow No + any other option
20	Question	With others?	Check Box (all that apply, but see note)	Alone, Friends, Acquaintances, Family members, Co-workers, Romantic partner	Don't allow Alone + any other option
21	Question	People eating?	Check Box (all that apply, but see note)	No, In my group, In view	Don't allow No + any other option
22	Question	Activities?	Check Box (all that apply)	Working/chores, Inactive/leisure, Interacting with others, Between activities, Other activities	
23	Question	Type of work?	Push Button (pick one)	Job, School, House/Personal, Other	Ask only if 21e=Working/chor
24	Question	Type of inactivity/leisure?	Push Button (pick one)	Media, Hanging out, Hobbies, Sports/Exercise, Reading, Waiting, Doing nothing, Other	Ask only if 21e=inactivity/leis
25	Question	Type of interaction with others?	Push Button (pick one)	Socializing, For business, Household issues, Arguing, Other interaction	Ask only if 21e=interacting wi others
26	Question	Would you like to eat right now but think that you shouldn't?	Slider	0-100 (with No!!-Yes!! anchors)	

Questionnaire: Evening Report

Q#	Type of Data	Text	Response type	Response options
	Instruction	The following questions refer to events occurring since the last morning report:		
1	Question	How many meals consumed today?	Spinner	0-10+
2	Question	How many snacks consumed today?	Spinner	0-10+
3	Question	How many drinks consumed today?	Spinner	0-10+
4	Question	Found yourself craving food at any stage?	Slider	0-100 (with No!!-Yes!! anchors)
5	Question	Was the craving intense?	Slider	0-100 (with No!!-Yes!! anchors)
6	Question	What type of food were you craving?	Push Button (pick one)	Biscuits/cakes/pastries, Fast food, Other
7	Question	Overall feeling	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good
8	Question	Energy level?	Slider	0-100 (with No!!-Yes!! anchors)
9	Question	Able to control important things?	Slider	0-100 (with No!!-Yes!! anchors)
10	Question	Able to handle personal problems?	Slider	0-100 (with No!!-Yes!! anchors)
11	Question	Nervous / stressed?	Slider	0-100 (with No!!-Yes!! anchors)
12	Question	Things going your way?	Slider	0-100 (with No!!-Yes!! anchors)
13	Question	Unexpected things upset you?	Slider	0-100 (with No!!-Yes!! anchors)
14	Question	Upset by things outside of your control?	Slider	0-100 (with No!!-Yes!! anchors)
15	Question	Meals consumed but NOT yet entered?	Spinner	0-5+
16	Question	Snacks consumed but NOT yet entered?	Spinner	0-10+
17	Question	Drinks consumed but NOT yet entered?	Spinner	0-10+
18	Question	Felt like eating but didn't'?	Slider	0-100 (with No!!-Yes!! anchors)
19	Question	Exercised today?	Push Button (pick one)	No, Yes
20	Question	How long did you exercise for?	Push Button (pick one)	0-10mins, 10-30mins, 30mins-1hour, 1-2hours, 2-3 hours,>3hours

Appendix G

Mplus output

Model 1: Predicting snacking from the presence of others eating

```
Mplus VERSION 7.4 DEMO (Mac)
MUTHEN & MUTHEN
09/13/2016   7:51 PM

INPUT INSTRUCTIONS

  TITLE:    1-1-1 mediation model with others eat and meals;
  DATA:     FILE     = RP_Food_compliant_2dec.dat;
            LISTWISE = ON;

  VARIABLE: NAMES    = subject day accept approve encourage
              oeat oeat_gr oeat_v rpmeal rpsnack rpsn_hi
              rpsn_lo;
            MISSING  = all(999);
            USEVAR   = subject x m1 m2 y;
            CLUSTER  = subject;
                WITHIN   = x ;
            CATEGORICAL = y;

  DEFINE:
           m1       = approve;
            m2      = encourage;
            x       = oeat; !This can be varied to examine the effects of others eating in
            y       = rpsnack; !This then needs to be changed for meals vs. rps and hi/lo s


  ANALYSIS: TYPE     = TWOLEVEL RANDOM;
            INTEGRATION = MONTECARLO;
            PROCESSORS = 8;

  MODEL:

  WITHIN
  y on  m1 (b1);
  y on  m2 (b2);
  y on x (c_);
  m1 on x (a1);
  m2 on x (a2);

  BETWEEN
  y;
  m1;
  m2;
  m1 with y m2;
  y with m2;

  MODEL CONSTRAINT:
  New (is1 is2 it c);
```

```
  is1 = a1*b1;
  is2 = a2*b2;
  it = is1 + is2;
  c = is2 + c_;

  Output: CINTERVAL;

*** WARNING
  Input line exceeded 90 characters. Some input may be truncated.
          x       = oeat; !This can be varied to examine the effects of others eating in v
*** WARNING
  Input line exceeded 90 characters. Some input may be truncated.
          y       = rpsnack; !This then needs to be changed for meals vs. rps and hi/lo
sn
   2 WARNING(S) FOUND IN THE INPUT INSTRUCTIONS

1-1-1 mediation model with others eat and meals;

SUMMARY OF ANALYSIS

Number of groups                                 1
Number of observations                        1407

Number of dependent variables                    3
Number of independent variables                  1
Number of continuous latent variables            0

Observed dependent variables

  Continuous
   M1          M2

  Binary and ordered categorical (ordinal)
   Y

Observed independent variables
   X

Variables with special functions

  Cluster variable      SUBJECT

  Within variables
   X


Estimator                                      MLR
Information matrix                        OBSERVED
Optimization Specifications for the Quasi-Newton Algorithm for
```

Continuous Outcomes
Maximum number of iterations 100
Convergence criterion 0.100D-05
Optimization Specifications for the EM Algorithm
Maximum number of iterations 500
Convergence criteria
Loglikelihood change 0.100D-02
Relative loglikelihood change 0.100D-05
Derivative 0.100D-02
Optimization Specifications for the M step of the EM Algorithm for Categorical Latent variables
Number of M step iterations 1
M step convergence criterion 0.100D-02
Basis for M step termination ITERATION
Optimization Specifications for the M step of the EM Algorithm for Censored, Binary or Ordered Categorical (Ordinal), Unordered Categorical (Nominal) and Count Outcomes
Number of M step iterations 1
M step convergence criterion 0.100D-02
Basis for M step termination ITERATION
Maximum value for logit thresholds 15
Minimum value for logit thresholds -15
Minimum expected cell size for chi-square 0.100D-01
Optimization algorithm EMA
Integration Specifications
Type MONTECARLO
Number of integration points 3000
Dimensions of numerical integration 3
Adaptive quadrature OFF
Monte Carlo integration seed 0
Link LOGIT
Cholesky OFF

Input data file(s)
RP_Food_compliant_2dec.dat
Input data format FREE

SUMMARY OF DATA

Number of clusters 60

UNIVARIATE PROPORTIONS AND COUNTS FOR CATEGORICAL VARIABLES

Y
Category 1 0.757 1065.000
Category 2 0.243 342.000

THE MODEL ESTIMATION TERMINATED NORMALLY

MODEL FIT INFORMATION

Number of Free Parameters 16

Loglikelihood

H0 Value -14065.689
H0 Scaling Correction Factor for MLR 1.8311

Information Criteria

Akaike (AIC) 28163.377
Bayesian (BIC) 28247.365
Sample-Size Adjusted BIC (n* = (n + 2) / 24) 28196.539

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
Y ON				
M1	0.012	0.003	3.711	0.000
M2	0.006	0.003	2.277	0.023
X	1.124	0.136	8.242	0.000
M1 ON				
X	12.068	2.569	4.697	0.000
M2 ON				
X	27.625	2.510	11.006	0.000
Residual Variances				
M1	647.529	74.985	8.635	0.000
M2	788.269	67.199	11.730	0.000
Between Level				
M1 WITH				
Y	-2.448	1.852	-1.322	0.186
M2	-21.200	37.505	-0.565	0.572
Y WITH				
M2	-1.697	1.696	-1.001	0.317
Means				

M1	71.033	3.013	23.572	0.000
M2	21.691	1.893	11.460	0.000

Thresholds

Y$1	2.701	0.243	11.118	0.000

Variances

Y	0.201	0.077	2.604	0.009
M1	257.647	45.237	5.695	0.000
M2	224.469	33.873	6.627	0.000

New/Additional Parameters

IS1	0.144	0.059	2.439	0.015
IS2	0.164	0.077	2.134	0.033
IT	0.308	0.077	3.985	0.000
C	1.288	0.142	9.045	0.000

LOGISTIC REGRESSION ODDS RATIO RESULTS

Within Level

Y ON	
M1	1.012
M2	1.006
X	3.076

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix 0.543E-07
(ratio of smallest to largest eigenvalue)

CONFIDENCE INTERVALS OF MODEL RESULTS

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
Within Level							
Y ON							
M1	0.004	0.006	0.007	0.012	0.017	0.018	0.020
M2	-0.001	0.001	0.002	0.006	0.010	0.011	0.013
X	0.773	0.857	0.899	1.124	1.348	1.391	1.475
M1 ON							
X	5.450	7.032	7.842	12.068	16.294	17.104	18.686
M2 ON							

X	21.160	22.706	23.496	27.625	31.754	32.545	34.091

Thresholds

Y$1	2.075	2.225	2.301	2.701	3.100	3.177	3.326

Residual Variances

M1	454.383	500.559	524.179	647.529	770.879	794.499	840.675
M2	615.177	656.558	677.726	788.269	898.811	919.979	961.360

Between Level

M1 WITH

Y	-7.217	-6.077	-5.494	-2.448	0.599	1.182	2.322
M2	-117.806	-94.710	-82.896	-21.200	40.497	52.311	75.407

Y WITH

M2	-6.066	-5.022	-4.487	-1.697	1.093	1.627	2.672

Means

M1	63.270	65.126	66.075	71.033	75.990	76.939	78.795
M2	16.816	17.981	18.577	21.691	24.804	25.401	26.566

Thresholds

Y$1	2.075	2.225	2.301	2.701	3.100	3.177	3.326

Variances

Y	0.002	0.050	0.074	0.201	0.328	0.352	0.400
M1	141.125	168.982	183.232	257.647	332.062	346.312	374.169
M2	137.220	158.079	168.749	224.469	280.190	290.860	311.718

New/Additional Parameters

IS1	-0.008	0.028	0.047	0.144	0.242	0.260	0.297
IS2	-0.034	0.013	0.038	0.164	0.290	0.314	0.362
IT	0.109	0.157	0.181	0.308	0.435	0.460	0.507
C	0.921	1.009	1.053	1.288	1.522	1.567	1.654

CONFIDENCE INTERVALS FOR THE LOGISTIC REGRESSION ODDS RATIO RESULTS

Within Level

Y ON

M1	1.004	1.006	1.007	1.012	1.017	1.018	1.020
M2	0.999	1.001	1.002	1.006	1.010	1.011	1.013
X	2.165	2.355	2.458	3.076	3.850	4.019	4.371

Model 2: Predicting high-energy snacking from the presence of others eating

```
Mplus VERSION 7.31
MUTHEN & MUTHEN
09/13/2016   1:42 PM

INPUT INSTRUCTIONS

  TITLE:    1-1-1 mediation model with others eat and meals;
  DATA:     FILE     = RP_Food_compliant_2dec.dat;
            LISTWISE = ON;

  VARIABLE: NAMES    = subject day accept approve encourage
              oeat oeat_gr oeat_v rpmeal rpsnack rpsn_hi
              rpsn_lo;
            MISSING  = all(999);
            USEVAR   = subject x m1 m2 y;
            CLUSTER  = subject;
            WITHIN      = x ;
            CATEGORICAL = y;

  DEFINE:
            m1 = approve;
            m2 = encourage;
            x    = oeat; !This can be varied to examine the effects of others eating in
            y    = rpsn_hi; !This then needs to be changed for meals vs. rps and hi/lo s


  ANALYSIS: TYPE      = TWOLEVEL RANDOM;
            INTEGRATION = MONTECARLO;
            PROCESSORS   = 8;

  MODEL:

  WITHIN
  y on  m1 (b1);
  y on  m2 (b2);
  y on x (c_);
  m1 on x (a1);
  m2 on x (a2);

  BETWEEN
  y;
  m1;
  m2;
  m1 with y m2;
  y with m2;

  MODEL CONSTRAINT:
```

```
  New (is1 is2 it c);
  is1 = a1*b1;
  is2 = a2*b2;
  it = is1 + is2;
  c = is2 + c_;

  Output: CINTERVAL;

*** WARNING
  Input line exceeded 90 characters. Some input may be truncated.
          x       = oeat; !This can be varied to examine the effects of others eating in v
*** WARNING
  Input line exceeded 90 characters. Some input may be truncated.
          y       = rpsn_hi; !This then needs to be changed for meals vs. rps and hi/lo sn
   2 WARNING(S) FOUND IN THE INPUT INSTRUCTIONS


1-1-1 mediation model with others eat and meals;

SUMMARY OF ANALYSIS

Number of groups                                 1
Number of observations                        1278

Number of dependent variables                    3
Number of independent variables                  1
Number of continuous latent variables            0

Observed dependent variables

  Continuous
   M1          M2

  Binary and ordered categorical (ordinal)
   Y

Observed independent variables
   X

Variables with special functions

  Cluster variable      SUBJECT

  Within variables
   X


Estimator                                       MLR
Information matrix                          OBSERVED
Optimization Specifications for the Quasi-Newton Algorithm for
```

Continuous Outcomes
Maximum number of iterations 100
Convergence criterion 0.100D-05
Optimization Specifications for the EM Algorithm
Maximum number of iterations 500
Convergence criteria
Loglikelihood change 0.100D-02
Relative loglikelihood change 0.100D-05
Derivative 0.100D-02
Optimization Specifications for the M step of the EM Algorithm for Categorical Latent variables
Number of M step iterations 1
M step convergence criterion 0.100D-02
Basis for M step termination ITERATION
Optimization Specifications for the M step of the EM Algorithm for Censored, Binary or Ordered Categorical (Ordinal), Unordered Categorical (Nominal) and Count Outcomes
Number of M step iterations 1
M step convergence criterion 0.100D-02
Basis for M step termination ITERATION
Maximum value for logit thresholds 15
Minimum value for logit thresholds -15
Minimum expected cell size for chi-square 0.100D-01
Optimization algorithm EMA
Integration Specifications
Type MONTECARLO
Number of integration points 3000
Dimensions of numerical integration 3
Adaptive quadrature OFF
Monte Carlo integration seed 0
Link LOGIT
Cholesky OFF

Input data file(s)
RP_Food_compliant_2dec.dat
Input data format FREE

SUMMARY OF DATA

Number of clusters 59

UNIVARIATE PROPORTIONS AND COUNTS FOR CATEGORICAL VARIABLES

Y
Category 1 0.833 1065.000
Category 2 0.167 213.000

THE MODEL ESTIMATION TERMINATED NORMALLY

MODEL FIT INFORMATION

Number of Free Parameters 16

Loglikelihood

H0 Value -12655.804
H0 Scaling Correction Factor for MLR 1.7354

Information Criteria

Akaike (AIC) 25343.608
Bayesian (BIC) 25426.057
Sample-Size Adjusted BIC (n* = (n + 2) / 24) 25375.233

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
Y ON				
M1	0.006	0.003	1.852	0.064
M2	0.008	0.003	2.480	0.013
X	1.464	0.180	8.132	0.000
M1 ON				
X	12.442	2.517	4.942	0.000
M2 ON				
X	27.812	2.793	9.959	0.000
Residual Variances				
M1	669.398	76.103	8.796	0.000
M2	777.139	68.122	11.408	0.000
Between Level				
M1 WITH				
Y	-3.202	2.566	-1.248	0.212
M2	-24.037	37.217	-0.646	0.518
Y WITH				

M2	-0.675	2.234	-0.302	0.762
Means				
M1	69.983	3.053	22.922	0.000
M2	21.136	2.465	8.573	0.000
Thresholds				
Y$1	2.991	0.250	11.949	0.000
Variances				
Y	0.325	0.102	3.170	0.002
M1	273.367	43.562	6.275	0.000
M2	222.019	34.240	6.484	0.000
New/Additional Parameters				
IS1	0.079	0.050	1.584	0.113
IS2	0.214	0.093	2.300	0.021
IT	0.293	0.086	3.391	0.001
C	1.678	0.170	9.869	0.000

LOGISTIC REGRESSION ODDS RATIO RESULTS

Within Level

Y ON	
M1	1.006
M2	1.008
X	4.323

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix 0.200E-04
(ratio of smallest to largest eigenvalue)

CONFIDENCE INTERVALS OF MODEL RESULTS

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
Within Level							
Y ON							
M1	-0.002	0.000	0.001	0.006	0.012	0.013	0.015
M2	0.000	0.002	0.003	0.008	0.013	0.014	0.016
X	1.000	1.111	1.168	1.464	1.760	1.817	1.928
M1 ON							
X	5.957	7.508	8.301	12.442	16.583	17.376	18.926
M2 ON							

X	20.618	22.338	23.218	27.812	32.406	33.285	35.005

Thresholds

Y$1	2.346	2.500	2.579	2.991	3.402	3.481	3.635

Residual Variances

M1	473.372	520.236	544.209	669.398	794.588	818.561	865.425
M2	601.671	643.620	665.079	777.139	889.199	910.658	952.607

Between Level

M1 WITH

Y	-9.812	-8.232	-7.423	-3.202	1.020	1.828	3.409
M2	-119.900	-96.982	-85.259	-24.037	37.185	48.908	71.826

Y WITH

M2	-6.429	-5.054	-4.350	-0.675	2.999	3.703	5.079

Means

M1	62.119	63.999	64.961	69.983	75.006	75.967	77.847
M2	14.785	16.303	17.080	21.136	25.192	25.968	27.486

Thresholds

Y$1	2.346	2.500	2.579	2.991	3.402	3.481	3.635

Variances

Y	0.061	0.124	0.156	0.325	0.493	0.526	0.589
M1	161.161	187.986	201.708	273.367	345.026	358.748	385.573
M2	133.823	154.908	165.694	222.019	278.344	289.130	310.215

New/Additional Parameters

IS1	-0.049	-0.019	-0.003	0.079	0.160	0.176	0.206
IS2	-0.026	0.032	0.061	0.214	0.368	0.397	0.454
IT	0.070	0.124	0.151	0.293	0.435	0.462	0.515
C	1.240	1.345	1.398	1.678	1.958	2.011	2.116

CONFIDENCE INTERVALS FOR THE LOGISTIC REGRESSION ODDS RATIO RESULTS

Within Level

Y ON

M1	0.998	1.000	1.001	1.006	1.012	1.013	1.015
M2	1.000	1.002	1.003	1.008	1.013	1.014	1.016
X	2.719	3.037	3.215	4.323	5.812	6.151	6.873

Model 3: Predicting low-energy snacking from the presence of others eating

```
Mplus VERSION 7.4 DEMO (Mac)
MUTHEN & MUTHEN
09/13/2016   9:06 PM

INPUT INSTRUCTIONS

  TITLE:    1-1-1 mediation model with others eat and meals;
  DATA:     FILE     = RP_Food_compliant_2dec.dat;
  LISTWISE = ON;

  VARIABLE: NAMES    = subject day accept approve encourage
            oeat oeat_gr oeat_v rpmeal rpsnack rpsn_hi
            rpsn_lo;
          MISSING  = all(999);
          USEVAR   = subject x m1 m2 y;
          CLUSTER  = subject;
          WITHIN   = x ;
          CATEGORICAL = y;

  DEFINE:
           m1     = approve;
           m2     = encourage;
           x      = oeat; !This can be varied to examine the effects of others eating in
           y      = rpsn_lo; !This then needs to be changed for meals vs. rps and hi/lo s

  ANALYSIS: TYPE     = TWOLEVEL RANDOM;
          INTEGRATION = MONTECARLO;
          PROCESSORS = 8;

  MODEL:

WITHIN
  y on  m1 (b1);
  y on  m2 (b2);
  y on x (c_);
  m1 on x (a1);
  m2 on x (a2);

  BETWEEN
  y;
  m1;
  m2;
  m1 with y m2;
  y with m2;

  MODEL CONSTRAINT:
  New (is1 is2 it c);
```

```
 is1 = a1*b1;
 is2 = a2*b2;
 it = is1 + is2;
 c = is2 + c_;

 Output: CINTERVAL;

*** WARNING
 Input line exceeded 90 characters. Some input may be truncated.
       x       = oeat; !This can be varied to examine the effects of others eating in v
*** WARNING
 Input line exceeded 90 characters. Some input may be truncated.
       y       = rpsn_lo; !This then needs to be changed for meals vs. rps and hi/lo sn
  2 WARNING(S) FOUND IN THE INPUT INSTRUCTIONS

1-1-1 mediation model with others eat and meals;

SUMMARY OF ANALYSIS

Number of groups                                 1
Number of observations                           1169

Number of dependent variables                    3
Number of independent variables                  1
Number of continuous latent variables            0

Observed dependent variables

 Continuous
  M1          M2

 Binary and ordered categorical (ordinal)
  Y

Observed independent variables
  X

Variables with special functions

 Cluster variable      SUBJECT

 Within variables
  X


Estimator                                       MLR
Information matrix                              OBSERVED
Optimization Specifications for the Quasi-Newton Algorithm for
Continuous Outcomes
```

Maximum number of iterations 100
Convergence criterion 0.100D-05
Optimization Specifications for the EM Algorithm
Maximum number of iterations 500
Convergence criteria
Loglikelihood change 0.100D-02
Relative loglikelihood change 0.100D-05
Derivative 0.100D-02
Optimization Specifications for the M step of the EM Algorithm for Categorical Latent variables
Number of M step iterations 1
M step convergence criterion 0.100D-02
Basis for M step termination ITERATION
Optimization Specifications for the M step of the EM Algorithm for Censored, Binary or Ordered Categorical (Ordinal), Unordered Categorical (Nominal) and Count Outcomes
Number of M step iterations 1
M step convergence criterion 0.100D-02
Basis for M step termination ITERATION
Maximum value for logit thresholds 15
Minimum value for logit thresholds -15
Minimum expected cell size for chi-square 0.100D-01
Optimization algorithm EMA
Integration Specifications
Type MONTECARLO
Number of integration points 3000
Dimensions of numerical integration 3
Adaptive quadrature OFF
Monte Carlo integration seed 0
Link LOGIT
Cholesky OFF

Input data file(s): RP_Food_compliant_2dec.dat
Input data format FREE

SUMMARY OF DATA

Number of clusters 60

UNIVARIATE PROPORTIONS AND COUNTS FOR CATEGORICAL VARIABLES

Y
Category 1 0.911 1065.000
Category 2 0.089 104.000

THE MODEL ESTIMATION TERMINATED NORMALLY

MODEL FIT INFORMATION

Number of Free Parameters 16

Loglikelihood

H0 Value -11401.509
H0 Scaling Correction Factor for MLR 1.7910

Information Criteria

Akaike (AIC) 22835.019
Bayesian (BIC) 22916.041
Sample-Size Adjusted BIC (n* = (n + 2) / 24) 22865.220

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
Y ON				
M1	0.024	0.007	3.509	0.000
M2	0.002	0.003	0.521	0.603
X	0.544	0.240	2.265	0.024
M1 ON				
X	9.162	2.693	3.403	0.001
M2 ON				
X	24.342	2.925	8.323	0.000
Residual Variances				
M1	670.613	78.842	8.506	0.000
M2	706.027	76.137	9.273	0.000
Between Level				
M1 WITH				
Y	-1.887	2.731	-0.691	0.490
M2	-28.524	36.169	-0.789	0.430
Y WITH				
M2	-2.611	2.243	-1.164	0.244
Means				
M1	71.073	2.019	35.197	0.000

M2	20.532	1.998	10.275	0.000
Thresholds				
Y$1	4.656	0.558	8.339	0.000
Variances				
Y	0.318	0.161	1.973	0.049
M1	296.713	58.835	5.043	0.000
M2	214.074	33.441	6.401	0.000
New/Additional Parameters				
IS1	0.221	0.110	2.021	0.043
IS2	0.043	0.084	0.516	0.606
IT	0.265	0.126	2.104	0.035
C	0.588	0.247	2.381	0.017

LOGISTIC REGRESSION ODDS RATIO RESULTS

Within Level

Y ON	
M1	1.024
M2	1.002
X	1.723

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix (ratio of smallest to largest eigenvalue)	0.130E-06

CONFIDENCE INTERVALS OF MODEL RESULTS

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
Within Level							
Y ON							
M1	0.006	0.011	0.013	0.024	0.035	0.038	0.042
M2	-0.007	-0.005	-0.004	0.002	0.007	0.009	0.011
X	-0.075	0.073	0.149	0.544	0.939	1.015	1.163
M1 ON							
X	2.227	3.885	4.733	9.162	13.591	14.440	16.098
M2 ON							
X	16.809	18.610	19.531	24.342	29.153	30.074	31.875

Thresholds

Y$1	3.218	3.561	3.737	4.656	5.574	5.750	6.094

Residual Variances

M1	467.532	516.083	540.918	670.613	800.308	825.143	873.694
M2	509.913	556.798	580.781	706.027	831.273	855.256	902.141

Between Level

M1 WITH

Y	-8.923	-7.241	-6.380	-1.887	2.606	3.466	5.148
M2	-121.688	-99.415	-88.022	-28.524	30.974	42.368	64.641

Y WITH

M2	-8.389	-7.008	-6.301	-2.611	1.079	1.786	3.167

Means

M1	65.871	67.115	67.751	71.073	74.394	75.030	76.274
M2	15.385	16.616	17.245	20.532	23.819	24.448	25.679

Thresholds

Y$1	3.218	3.561	3.737	4.656	5.574	5.750	6.094

Variances

Y	-0.097	0.002	0.053	0.318	0.584	0.634	0.734
M1	145.166	181.396	199.929	296.713	393.496	412.029	448.260
M2	127.936	148.529	159.063	214.074	269.085	279.619	300.212

New/Additional Parameters

IS1	-0.061	0.007	0.041	0.221	0.402	0.436	0.504
IS2	-0.174	-0.122	-0.095	0.043	0.182	0.209	0.261
IT	-0.059	0.018	0.058	0.265	0.472	0.512	0.589
C	-0.048	0.104	0.182	0.588	0.993	1.071	1.223

CONFIDENCE INTERVALS FOR THE LOGISTIC REGRESSION ODDS RATIO RESULTS

Within Level

Y ON

M1	1.006	1.011	1.013	1.024	1.036	1.038	1.043
M2	0.993	0.995	0.996	1.002	1.007	1.009	1.011
X	0.928	1.076	1.161	1.723	2.558	2.759	3.199

Mplus VERSION 7.4 DEMO (Mac) has the following limitations:
  Maximum number of dependent variables: 6
  Maximum number of independent variables: 2
  Maximum number of between variables: 2

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